INTERNATIONAL JOURNAL of CONTEMPORARY EDUCATIONAL RESEARCH

Volume 8 | Issue 1 | Year 2021 | e-ISSN: 2148-3868

JCER

IJCER

International Journal of Contemporary Educational Research

March 2021 **Volume: 8** **Issue: 1** **e-ISSN: 2148-3868**

http://ijcer.net/

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International Journal of Contemporary Educational Research (IJCER)

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Testing the Vallerand's Motivational Sequence in Physical Education: The Invariance of Teachers' Motivation to Teach

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To cite this article:

Erturan, G. (2021). Testing the Vallerand's motivational sequence in physical education: The invariance of teachers' motivation to teach. *International Journal of Contemporary Educational Research*, *8*(1), 1-13. DOI: https://doi.org/10.33200/ijcer.810477

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International Journal of Contemporary Educational Research
Volume 8, Number 1, March 2021, 1-13 ISSN: 2148-3868

Testing the Vallerand's Motivational Sequence in Physical Education: The Invariance of Teachers' Motivation to Teach

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Abstract

The aims of this study were to test the Vallerand's motivational sequence model in physical education and to examine the invariance of the model across PE teachers' motivation to teach. The study was conducted with 177 high school PE teachers and their 461 students. Motivation to Teach Scale was applied to PE teachers. "Highly intrinsically motivated" and "highly extrinsically motivated" teachers were determined based on the results obtained from this scale. Two highest intrinsically motivated teachers and three highest extrinsically motivated teachers were reached again and their students' autonomy support, basic psychological needs satisfaction, situational motivation, subjective vitality, and concentration were assessed. Structural equation modelling and Ward invariant analysis were used for the data analysis. Results showed that the more teachers are intrinsically motivated for her profession, the more their students' autonomy need satisfaction negatively explains their amotivation level in physical education. Perceived autonomy support is the trigger and autonomy need satisfaction is the most important variable in the whole motivational model. Thus, physical education teachers are recommended to create a lesson environment providing autonomy support and considering autonomy need satisfaction to increase students' well-being.

Key words: Autonomy support, Basic psychological needs, Student motivation, Teacher motivation, Well-being

Introduction

Self-determination Theory (SDT; Deci & Ryan, 1985) has been extensively explored to predict various cognitive, affective, and behavioral outcomes in school physical education (PE) (Ntoumanis & Standage, 2009). SDT makes a distinction between different explanations for an action or inaction. Various forms of motivation were proposed to compensate for driven behavior, including intrinsic motivation, extrinsic motivation, and amotivation (Standage et al., 2006). According to SDT, intrinsic motivation is identified by behavior for the pleasure, value, and fulfillment of the task itself. For example, because of feelings of fulfillment and enjoyment that result directly from the activities offered by the PE program, an intrinsically motivated student will engage in PE. Extrinsic motivation, on the other hand, involves behaviors carried out for purposes other than an inherent interest in the task (performing an activity is directed by a separable threat, reward, or punishment (Deci & Ryan, 1985). For example, an extrinsically motivated student would participate PE because of a fear of failing the class or getting low grade.

SDT defines four different types of extrinsic motivation which differ in degree of self-determination. The lowest degree of self-determination corresponds external regulation which means the behaviors taken to receive an external reward and/or to avoid any kind of penalty. Introjected regulation is a type of extrinsic motivation defined by the internalization of external regulations. Identified regulation refers to human identification with an activity that is central to one's goals (Ryan & Deci, 2002). The highest degree of self-determination corresponds integrated regulation applies to identifications that were embedded into the self and in line with individuals' certain values and needs (Ryan & Deci, 2000a; Standage et al., 2006). Lastly, amotivation is the lack of motivation, more specifically a belief that an action is unimportant and/or that a person does not consider contingencies between his/her actions and the intended outcomes (Ryan & Deci, 2002).

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Vallerand (1997) proposed a hierarchical model within SDT, which social factors (i.e. autonomy support) effect psychological mediators; which in turn effect motivation; which finally effects consequence variables (Figure 1). This provides a framework for not only identifying motivational factors, but also analyzing the affect these have on intrinsic motivation, extrinsic motivation and amotivation. The framework also provides for the examination of the consequences of different types of motivation.

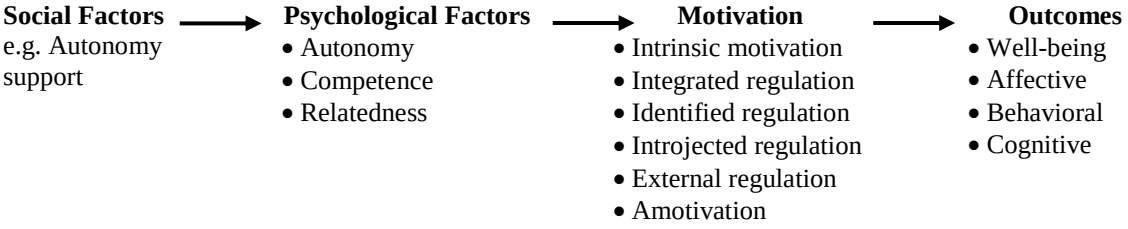

Figure 1. Vallerand's hierarchical model of motivation

In Vallerand's (1997) motivational sequence model antecedent of psychological mediators is teacher created autonomy support. Autonomy-supportive behavior includes having adopted one's own views and emotions, providing rationale, decision to make and encouraging self-sponsored activity (Jang et al., 2010). It is known that teachers' support of the students' autonomy in a learning environment foster students' basic psychological needs (e.g. Reeve, 2009). To be more specific, these are autonomy, competence, and relatedness needs.

According to SDT, the need for autonomy refers to experiencing a sense of psychological freedom, feelings of volition vitality, and initiative (Deci & Ryan, 1985), the need for competence refers to feeling capable to achieve success (Deci & Ryan, 1985), and relatedness refers to experiencing meaningful connections with the others (Ryan & Deci, 2000b). SDT implies that the fulfilling of these three psychological requirements are important for integrity, progress, positive functioning and well-being in all domains and developmental cycles but when these are not met, various maladaptive outcomes, such as anxiety, anger and such negative emotions occur (Ryan & Deci, 2000b). Previous research within the framework of SDT reveals that when teachers are autonomy supportive versus controlling has a direct effect on students' intrinsic motivation (Reeve, Bolt, & Cai, 1999; Guay, Boggiano & Vallerand, 2001) and indirect effect on outcome variables such as students' autonomous self-regulation (Reeve et al., 1999).

Teacher's Motivation to Teach

SDT notes that teachers who are intrinsically motivated to teach find the teaching extremely rewarding, and they are enthusiastic and dedicated to teaching (Fernet et al., 2016). On the other hand, teachers who are extrinsically motivated put energy into their teaching whether it is what is requested of them or whether they sense an intrinsic urge to do so, with the commitment in teaching becoming practical in order to escape feelings of shame or to enhance their self-worth (Niemiec & Ryan, 2009). When teachers have amotivation for teaching, their intention to teach is absent, either because teachers do not feel capable to teach or because they do not value the teaching (Ryan & Deci, 2002).

In a study by Tilga et al., (2020), it was found that the effect of PE teachers' autonomy supportive behavior on students' intrinsic motivation was partially mediated by basic psychological need satisfaction. That is, higher levels of controlling behavior minimize the indirect impact of perceived autonomy supportive behavior on intrinsic motivation by fulfilling basic psychological needs. Students can experience PE teacher's autonomy supportive behaviors that has shown to enhance students' psychological needs, which, in turn, predicts self-determined motivate on and adaptive outcomes (e.g. De Meyer et al., 2014; Haerens et al., 2015).

The Role of Teacher's Motivation in Vallerand's Motivational Sequence

Previous work has found that teachers who were intrinsically motivated to teach were more inclined to promote student autonomy, and this in effect, contributed to an improvement in students' intrinsic motivation. For example, Roth, et al. (2007) found that elementary school teachers' autonomous motivation for teaching increased students' autonomous motivation for learning by enhancing teachers' autonomy-supportive behavior. In a similar vein Pelletier, Seguin-Levesque and Legault (2002) conducted a study with primary, elementary,

and high school students and found that the less teachers were self-determined toward teaching, the more they became controlling with students. In project-based learning environment when teachers indicated higher intrinsic motivation, their secondary school students appeared to gain more support from them and to express higher intrinsic motivations for learning experience (Lam et al., 2009).

Studies with undergraduate students replicates the findings with elementary students. Namely, Wild et al. (1997) have found that undergraduate students who have been taught by an extrinsically motivated teacher have demonstrated reduced interest in learning and less enjoyment of the task than those taught by an intrinsically motivated teacher. In addition, when these students were asked to act as teachers, their students reported lower levels of interest, enjoyment of task, and positive mood. Similarly, Wild and Hawkins (1992) stated that volunteer teachers' undergraduate students were more intrinsically motivated to learn playing the piano, enjoyed piano lesson more and had greater desire to play piano following the lesson compared to the students whose teachers were paid. Moreover, students in volunteer teaching condition engaged more in new exploration after the piano lesson. Another research with college students revealed that students who considered their teachers to be enthusiast consequently registered greater inner enthusiasm for teaching materials and exhibited higher degrees of vitality (Patrick et al., 2000).

Roth et al (2007) argued three processes that explain autonomous motivation to teach might lead to autonomy-supportive teaching. Firstly, teachers who have autonomous motivation gained a broad knowledge of the importance of the methods they use and the content they teach, and offer persuasive descriptions and examples to their students of the relevance of those subjects and their teaching methods. Knowing that the students have many different ways to learn allow teachers to offer their students some choice. The second process is related to teachers' experience of motivation and its benefits. Teachers who have witnessed the benefits of autonomous motivation recommend that their students often behave and learn from autonomous motivations, as they recognize that these forms of incentives contribute to good quality performance and greater understanding of the topics they teach and enjoy. Autonomously motivated teachers then use their own motivational experiences as a basis for inferring that if the students understood the value of the subject being learned and found it interesting, they would engage in learning in the most serious way. Lastly, greater resistance of autonomous teachers to performance demands and questions regarding making perceptions, and greater engagement by these teachers in high quality learning. Teachers who are more autonomously motivated are more likely to give any option to take the time to explain the importance of various subjects as they are less pressed to deliver fast to spectacular formal successes, and are more concerned with fostering a thorough comprehension of the subjects they teach.

Present Study

According to Niemiec and Ryan (2009), teachers' motivation to teach might act as an energy supplier. Previous studies have some evidence related to teachers' motivation to teach may affect student variables in Vallerand's (1997) model. Teachers' autonomous motivation to teach was hypothesized to lead to autonomy-supportive teaching, in parallel with that extrinsic motivation to teach may decreases the autonomy supportive teaching (e.g. Roth et al., 2007). It was also hypothesized that creating need supportive learning environment differs according to the teachers' motivation to teach. Because autonomously motivated teachers engage more in their teaching planning by aligning course resources with students' desires and values, they are more open to students' feedback and viewpoints while teaching, they express their goals more clearly, they offer more guidance, and they provide more help and encouragement (Vermote et al, 2020). According to the evidence for the effect of teachers' motivation for teaching on students' motivation for learning (e.g. Lam et al., 2009), students of PE teachers that intrinsically motivated to teach were hypothesized to have higher levels of intrinsic motivation compared to students whose PE teachers were extrinsically motivated to teach. To sum up, it was hypothesized that PE teachers who were externally motivated were more controlling, create a learning environment that frustrate students' basic psychological needs, foster students' extrinsic regulation, amotivation and undermine students' concentration and vitality than teachers who were more intrinsically motivated to teach.

Yet, to our knowledge, there is no published evidence testing that whether Vallerand's (1997) full model changed according to the teachers' motivation to teach. Therefore, the aim of this study was twofold: firstly, to test the complete sequence of Vallerand's (1997) model in PE, secondly to examine the invariance of the model across PE teachers' motivation to teach. Hypothesized model is shown in Figure 2.

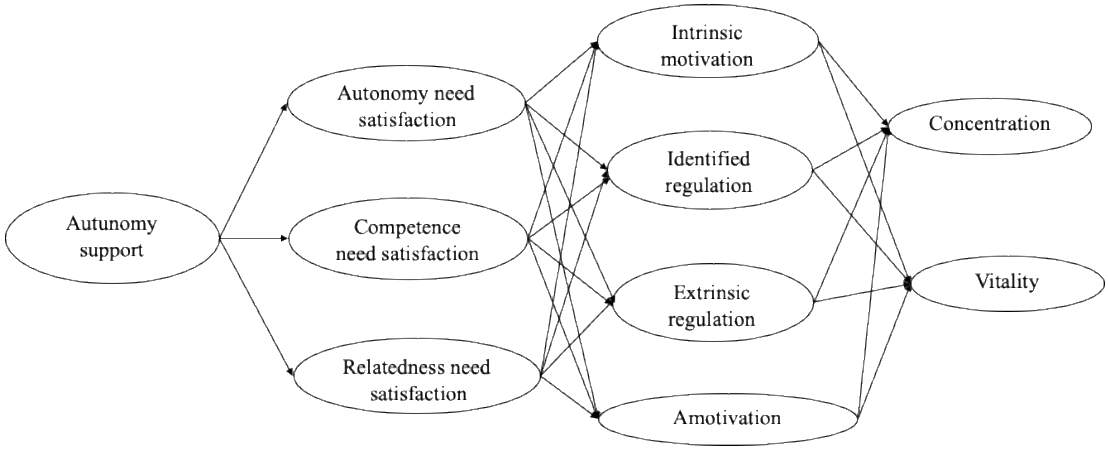

Figure 2. Hypothesized model

Methods

This study is cross-sectional and correlational.

Participants

The study was conducted with 177 PE teachers (39 females, 138 males; M_{age} = 40.57 ± 7.48 years) working in 87 different high schools and 461 high school students (253 females, 208 males; M_{age} = 15.65 ± 0.96 years) in central province of southern city in Turkey. Motivation to Teach Scale was administered to PE teachers. Then, they were divided into two categories as "highly intrinsically motivated to teach" and "highly extrinsically motivated to teach" based on the results obtained from Motivation to Teach Scale. The researcher met the highest intrinsically motivated two PE teachers and the highest extrinsically motivated three PE teachers. Three classes of each teacher were randomly selected. Student questionnaire pack was administered to all students in each selected class.

Instruments

Motivation to Teach Scale
Kauffman, Yılmaz-Soylu and Duke (2011) developed the scale Güzel Candan and Evin Gencel (2015) translated it into Turkish. The scale consists of two subscales, namely intrinsic and extrinsic motivation. Totally 12 items are rated in a 6-point Likert scale. CFA was done for the validity of the Turkish data with the scale and results were satisfactory (X^2/df=4.25; RMSEA=0.08; SRMR=0.04; CFI=0.93; NFI=0.91; p=0.001).

Perceived Autonomy Support Scale for Exercise Settings
Hagger et al. (2007) developed the scale and and Müftüler (2016) translated it into Turkish. The scale has one dimension and 12 items measured on 7-point Likert scale. In this study confirmatory factor analysis (CFA) was performed and results revealed a valid scale for PE setting (X^2/df=4.22; RMSEA=0.07; SRMR=0.04; CFI= 0.93; NFI=0.91; p=0.001).

Basic Psychological Needs Scale
Deci and Ryan (1991) developed the scale and Cihangir-Çankaya and Bacanlı (2003) translated it into Turkish. The scale has three subscales; autonomy, competence and relatedness subscales. Students indicated totally 21 items the extent to which they agreed with each response using a 7-point scale. CFA were done in this study and it showed that the scale revealed a valid structure (X^2/df=4.62; RMSEA=0.10; SRMR=0.09; CFI= 0.55; NFI=0.51; p=0.001).

Situational Motivation Scale
Guay et al., (2000) developed the scale and Daşdan Ada et al. (2012) translated it into Turkish. It has intrinsic motivation, identified regulation, extrinsic regulation and amotivation subscales. Students indicated 16 items the extent to which they agreed with each response using a 7-point scale. CFA results showed that the scale revealed a valid structure (X^2/df=4; RMSEA=0.08; SRMR=0.07; CFI= 0.90; NFI= 0.87; p=0.001; Erturan-İlker et al., 2018).

Subjective Vitality Scale
Ryan and Frederick (1997) developed the scale and Erturan-İlker et al. (2018) translated it into Turkish. The scale has one-dimension and seven items measured on 7-point Likert. CFA results showed that the scale revealed a valid structure (X^2/df=4.41; RMSEA=0.09; SRMR=0.05; CFI= 0.94; NFI= 0.93; p=0.001).

Concentration in PE Scale
Standage et al (2005) developed the scale and Erturan-İlker et al. (2018) translated it into Turkish. The scale has one-dimension and six items measured on 5-point Likert. CFA results showed that the scale revealed a valid structure (X^2/df=4.9; RMSEA=0.09; SRMR=0.04; CFI= 0.96; NFI= 0.95; p=0.001).

Procedures

The population of high school PE teachers in data collection province was 195. Six teachers did not volunteer to participate and 12 teachers were on annual leave or out of school due to the health problems. So, totally 177 high school PE teachers were determined as the sample of the study. After getting permissions from Ministry of National Education, PE teachers were met at their schools and consent forms were given. One week after consent forms were given, Motivation to Teach Scale was applied while teachers had no lesson during the school time.

The data obtained from the Motivation to Teach Scale was analyzed and two highest intrinsically and two highest extrinsically motivated teachers were determined. Because two teachers had the same extrinsic motivation mean value, both of them were taken and consequently, two intrinsically and three extrinsically motivated PE teachers were included to the study. The researcher met again with these teachers individually during their free time at the school and three classes of each PE teacher were randomly selected. The following week, student and parent consent forms were distributed to all students in those classes during their scheduled PE lessons. One week after the consent forms were delivered, the student questionnaire pack was administered during their scheduled PE lessons to the students who were volunteer to participate to this study. PE teachers were not present during the data collection, students were explained that their participation was anonymous, they were free to withdraw from the study in any time, the data would only be used for research purposes and will not be shared by the others.

Data Analysis

Firstly, CFA was done for each scale of the study using AMOS Version 5.0 (Arbuckle, 2003). Standard error estimations were made by Bootstrapping technique. Descriptive analysis and Pearson correlation among variables were calculated using SPSS Statistics for Windows, Version 16.0 (IBM Corp., 2007). Then, hypothesized model was tested for the whole group using AMOS 5.0 (Arbuckle, 2003) and lastly it was tested for both samples individually with using Ward analysis. Table 1 shows the acceptable model fit indices.

Results

Normality of the study variables, Cronbach's alpha reliability scores for each subscale and descriptive values for each variable were calculated. Descriptive analysis, reliability and normality scores are given in Table 1.

Table 1. Descriptive data and Cronbach's alpha values of the study variables

Variables	Min	Max	α	M	SD	Skewness	Kurtosis
Autonomy support	1.25	7.00	0.72	5.72	1.24	-1.043	1.464
Autonomy need satisfaction	1.83	7.00	0.79	5.11	1.00	-.220	-.284
Competence need satisfaction	2.00	7.00	0.82	4.77	0.96	.044	-.398
Relatedness need satisfaction	2.67	7.00	0.83	5.39	0.97	-.476	-.333
Intrinsic motivation	1.25	7.00	0.88	5.72	1.26	-1.161	1.216
Identified regulation	1.00	7.00	0.75	5.59	1.36	-1.084	.493

Extrinsic regulation	1.00	7.00	0.78	3.91	1.70	.076	-1.071
Amotivation	.73	7.00	0.89	3.07	1.64	.517	-.675
Vitality	1.00	7.00	0.96	4.99	1.23	-.578	.019
Concentration	1.67	5.00	0.94	3.70	0.60	-.703	.230

Table 1 shows that all the subscales had internal consistency (i.e. >0.70) and data was normally distributed. Pearson correlation analysis was computed to see the relations among the study variables. Table 2 shows the correlation among the variables.

Table 2. Correlation coefficients for all variables included in the study

	1	2	3	4	5	6	7	8	9
1.Autonomy support	-								
2.Autonomy need satisfaction	.274**	-							
3. Competence need satisfaction	.193**	.483**	-						
4. Relatedness need satisfaction	.352**	.528**	.465**	-					
5. Concentration	.390**	.239**	.342**	.312**	-				
6. Vitality	.295**	.278**	.369**	.388**	.400**	-			
7.Intrinsic motivation	.375**	.102*	.122**	.186**	.401**	.304**	-		
8.Identified regulation	.399**	.117*	.151**	.155**	.427**	.330**	.759**	-	
9.Extrinsic regulation	-.143**	-.151**	-.129**	-.108*	-.242**	-.105*	-.204**	-.184**	-
10. Amotivation	-.269**	-.311**	-.230**	-.284**	-.341**	-.206**	-.256**	-.253**	.594**

*p<.05 **p<.01

The findings obtained from Pearson correlation analysis were supported the theoretical tenets of SDT. Namely, autonomy support and satisfaction of all three basic psychological needs positively correlated with each other, intrinsic motivation, identified regulation, concentration and vitality, while negatively correlated with extrinsic motivation and amotivation. Identified regulation and intrinsic motivation positively correlated with each other, concentration, and vitality, while negatively correlated with extrinsic motivation and amotivation. In a similar vein, extrinsic motivation and amotivation had a positive relation with each other but had negative correlations with all other variables in the study.

Table 3. Model fit indices

Model Fit Indices	Model	Acceptable Fit
X^2/df	1.85	$0 < X^2/df < 5$
CFI	0.91	$0.90 \leq CFI \leq 1.0$
NFI	0.89	$0.90 \leq NFI \leq 1.0$
RMSEA	0.05	$0.00 \leq RMSEA \leq 0.10$
SRMR	0.09	$0.00 \leq SRMR \leq 0.10$

Table 3 shows that the data has acceptable fit with the model. Figure 3 shows the final model obtained from the data.

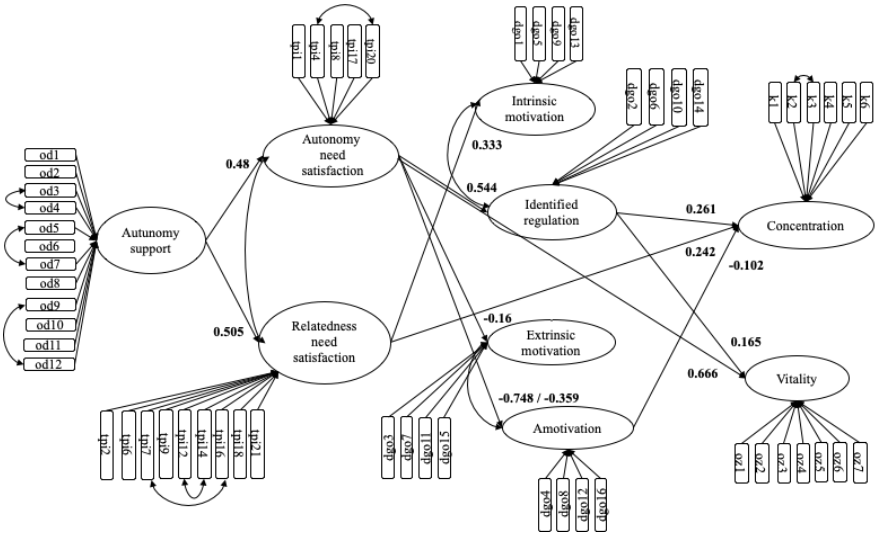

Figure 3. Final model

Note: All the shown paths are significant (p<.001)

Final model supported the motivational sequence that Vallerand (1997) proposed. Perceived autonomy support positively predicted students' autonomy and relatedness need satisfaction. Autonomy need satisfaction positively predicted identified regulation and vitality, while negatively predicted extrinsic motivation and amotivation. Relatedness need satisfaction positively predicted intrinsic motivation and concentration. Identified regulation positively predicted concentration and vitality and lastly, amotivation negatively predicted concentration. Table 4 shows the indirect effects among variables.

Table 4. Indirect effects of the model

rhs	est	se	z	p
Autonomy support*autonomy need*identified regulation	0.261	0.027	9.773	<0.001
Autonomy support*autonomy need*vitality	0.319	0.038	8.392	<0.001
Autonomy support*autonomy need*identified regulation*concentration	0.068	0.009	7.204	<0.001
Autonomy support*relatedness need*intrinsic motivation	0.168	0.021	7.879	<0.001
Autonomy support*relatedness need*concentration	0.122	0.022	5.436	<0.001
Autonomy need*identified regulation*concentration	0.142	0.022	6.352	<0.001
Autonomy need*identified regulation*vitality	0.09	0.027	3.366	0.001
Autonomy need*identified regulation*vitality + Autonomy need*vitality	0.755	0.08	9.476	<0.001

To test indirect relationships in this model, variables that serves as fully and partially mediator were determined. Basically, three mediators were defined; autonomy need satisfaction, relatedness need satisfaction and identified regulation. Autonomy need satisfaction which fully mediated relationships between the autonomy support and identified regulation; autonomy support and vitality; autonomy support, autonomy need satisfaction, identified regulation and concentration. Second mediator, relatedness need satisfaction fully mediated the relationships between autonomy support and intrinsic motivation; autonomy support and concentration. Last mediator, identified regulation fully mediated the relations between autonomy need satisfaction and concentration; autonomy need satisfaction and vitality; while it partially mediated the relationship between autonomy need satisfaction and vitality.

To test whether Vallerand's (1997) model on students' invariant across PE teachers' motivation to teach, Ward analysis was used, that is shown in Table 5.

Table 5. Ward analysis results

	Model 1	Model 2	Model 3
Df	2908	2898	2909
AIC	92039.98	92038.62	92045.22
Chisq	5381.17	5359.803	5388.403
CFI	0.81	0.8	0.8
NNFI	0.8	0.79	0.79
SRMR	0.093	0.094	0.094
RMSEA	0.052	0.052	0.052
Chisq diff		16.603	4.7
Df diff		10	1
p (>Chisq)		0.084	0.03

Note:
M1: It assumes that all regression parameters are same except f1.
M2: It assumes that all regression parameters are different.
M3: It assumes that all regression parameters are same.

Firstly, M1 and M2 were compared to see whether different regression parameters were required across motivation groups. Since M2 was significant (p = 0.084), it was concluded that those two models did not differ. We can at least keep the other parameters same across the two groups except the link between autonomy need and amotivation. Secondly, M1 and M3 were compared to see whether same regression parameters could be used across motivation groups. With the p value since M3 was significant (p=0.03), it was concluded that those two models differ, and we could not use the same parameter for at least the link between autonomy need and amotivation. As a result, parameter of the link between autonomy need and amotivation could not be same for both motivation groups. Although most parameters were same, two models were not identical.

The results of Ward analysis revealed that this model showed partial invariance between students whose teachers had high intrinsic motivation to teach and students whose teachers had high extrinsic motivation to teach. The only distinctive relationship in the model was between the autonomy need satisfaction and amotivation. Namely, if the PE teacher was intrinsically motivated to the profession, the level of students' perceived autonomy support negatively predicted amotivation was increased.

Discussion

In the current study, we add to the existing literature by testing a Vallerand's (1997) model based on SDT to investigate the processes by which autonomy-supportive lesson created by teachers influence students' basic psychological needs, which in turn predicted motivational regulations, which lead to concentration and vitality in Turkish PE environment. Study results proved that the students' level of perceived autonomy support in PE satisfies the students' need for autonomy and relatedness, increases students' identified regulation and intrinsic motivation, decreases the external regulation and amotivation, and accordingly, increases the psychological well-being (i.e. concentration and vitality) respectively. This information enables PE teachers to understand how to develop a more adaptive learning environment to promote adolescents' basic psychological needs, self-determined motivation, and optimal functioning in high school compulsory PE setting.

In this study three mediators, autonomy need satisfaction, relatedness need satisfaction and identified regulation fully and partially mediates various relationships. Examining these relationships in depth can make the model easier to understand. First mediator is autonomy need satisfaction which fully mediates the relationship between the autonomy support and identified regulation; autonomy support and vitality; while partially mediates the relationship between the autonomy support, identified regulation and concentration. In other words, students' autonomy need satisfaction in PE predicts psychological (i.e. vitality) and mental (i.e. concentration) well-being.

Second mediator the only motivational regulation that is serve as a bridge between basic psychological needs and both outcome variables (i.e. vitality and concentration) in this study is identified regulation. Identified regulation is the individual's participation in the activity on the grounds of a belief of behavior is important and contributes to one's personal development (Ryan & Deci, 2000a). Some students, for example, may engage in PE because they appreciate the significance of exercise for their health (Ntoumanis, 2005). Although identified regulation represents the behavior performed in order to achieve personal goals, not for its own sake, it represents fully integrated and self-determined forms of behavior (Deci & Ryan, 1991). That is to say with identified regulation, one's action is more self-determined. When describing an operation as relevant to personal

objectives, the individual makes more decisions about his or her engagement than when new and additional regulatory models are in effect (Ntoumanis, 2001). Therefore, the development of identified regulation seems important. To enhance students' identified regulation for PE, teachers can emphasize the link between physical activity and health, so that students can understand the importance of the lesson for their health and well-being in their future life. In their study Ulstad, Halvari, and Deci (2019) proved the link between teachers' perceptions about students' identified regulation and students' actual level of identified regulation. The ability of seeing the signals of students' identified regulation enabled them to give optimal teaching. Therefore, teachers are also recommended to

Third and last mediator in this model is relatedness need satisfaction. Students' relatedness need satisfaction in PE fully mediates the relationship between perceived autonomy support and intrinsic motivation. Relatedness is essential for growth and well-being (Ryan & Deci, 2000b; Holt et al., 2019). The structure of the PE lessons contains cooperative activities allowing stronger feelings of relatedness among students (Ntoumanis, 2001). Vasconcellos et al. (2020) argued that relatedness in PE is associated with both peer and teacher influences.

In a similar vein students' relatedness need satisfaction in PE fully mediates the relationship between perceived autonomy support and concentration as a well-being parameter. As most work has shown that positive interactions and feelings of relatedness are linked to psychological well-being (e.g., La Guardia et al., 2000). Vallerand and Losier (1999) proposed cooperation make an activity inherently more interesting which promotes students' intrinsic motivation toward the activity. Therefore, teachers are recommended to promote the communication among students, use a positive language and show interest to their students to foster relatedness need satisfaction.

Students who perceived an autonomy supporting PE environment experienced greater levels of autonomy and relatedness need satisfaction. However, the results revealed that the competence need satisfaction was not predicted by perceived autonomy support or any other variable in the model. This result is surprising, because PE lessons are the environments that contain virtually all members of an age cohort with quite discrepant physical ability levels (Ntoumanis, 2005). Due to the nature of PE lessons, all students exhibit the requirements of the lesson, mostly psychomotor skills, in front of their other friends and PE teacher. That is, perception of competence is very significant in PE, as differences in the degree of physical capacity can be easily detected. Therefore, it is possible that even children who feel and are physically capable will consider PE enjoyable and fun and may continue to take part in it and help improve their athletic abilities (Ntoumanis, 2002; 2005). Similarly, Goudas and Biddle (1994) found that students' perceived competence in PE explained a significant amount of variance in intrinsic motivation scores of British PE students.

The fact that need for competence is not explained by any variable in the SEM model in this study is surprising due to its vital importance in PE lessons. However, Reis et al. (2000)'s point is also important, they claimed that all three basic psychological needs does make an independent contribution to the prediction of daily well-being. Moreover, existing knowledge both in sport (e.g. Blanchard & Vallerand, 1996) and PE contexts (e.g. Standage & Duda, 2005; Zhang et al., 2011; Behzadnia et al., 2018) showed through a path analysis that all three basic psychological needs mediated the relationship between autonomy support and situational self-determined motivation.

Second aim of this study was to test whether Vallerand's (1997) model was invariant across PE teachers' different motivational regulations to teach. We hypothesized that teachers whether having intrinsic or extrinsic motivation to teach would affect students' perceived autonomy support, basic psychological needs, motivational regulations for learning, subjective vitality, and concentration differently in PE. However, this study proved that Vallerand (1997)'s sequence of motivational process works similar for highly intrinsically motivated teachers' and highly extrinsically motivated teachers' students. In other words, the PE teachers saying "I can't imagine a job other than teaching" creates similar learning environment for their students with the teachers saying "I prefer to be a teacher because it is easy to find a job" in terms of Vallerand's (1997) motivational sequence.

The only difference between two models was the relationship between the autonomy need satisfaction and amotivation. The students whose PE teachers were highly intrinsically motivated to teach, have higher level of predictive level of autonomy need satisfaction for amotivation. That is to say, the more PE teachers are intrinsically motivated for their profession, the more their students' autonomy need satisfaction negatively explains their amotivation level in PE.

Neşe (2018) stated that Turkish teachers were motivated with intrinsic and extrinsic factors such as being successful, effective working condition, students' desire for learning, being more autonomous, equitable and consistent implementations regarding with project-based education approach. Existing literature has evidence for how teachers' intrinsic and extrinsic motivation could either directly affect their teaching behaviors or

mediate the effect between contextual factors and teaching behaviors. For example, Vermote et al. (2020) argued that autonomously motivated teachers are likely to have more energy at their disposal, contributing to their alertness and psychological availability in teaching, thus providing maximum support for students' psychological needs. Presumably, since teaching needs so much work on the part of managed motivated teachers, they have little ability to adapt their point of view to their students' experiences, using more harsh language and aggressive tactics as they encounter opposition, and ultimately give up on students who refuse to agree or who do not make enough progress.

Fernet et al. (2016) found that early career middle and high school teachers' autonomous motivation positively predicts behaviors related to fostering student attentiveness in the classroom. Conversely, teachers' controlled motivation negatively predicts student attentiveness. Pelletier, Seguin-Levesque and Legault (2002) found that the more teachers perceive pressure from above (they have to comply with a curriculum, with colleagues, and with performance standards) and pressure from below (they perceived their students to be non-self-determined), the less they are self-determined toward teaching.

Autonomy support is the trigger of the whole motivational model. It is not possible for any of the psychological effects in this motivational model to occur without teachers' autonomy support. Thus, PE teachers are recommended to create a PE environment to provide autonomy support to increase the well-being of their students. Reeve and Cheon (2016) identified six strategies for PE teachers to create autonomy supportive environment; taking the perspective of their students; introducing activities that vitalize and support the psychological needs; providing explanatory rationales for their requests; communicating using informational language; acknowledging and accepting expressions of negative affect; and displaying patience. Similarly, Tilga (2019) elaborated the autonomy supportive strategies for teachers in PE as allowing students to choose their sports equipment, accepting students' solutions in learning exercises, allowing students to express their own opinions, providing responses to students when they express their opinion, explaining the effect of exercise on health, guiding students toward finding solutions to problems without directly revealing the answer.

Limitations and Future Directions

This study has a couple of limitations. Firstly, only teachers who have high level of intrinsic motivation and extrinsic regulation and their students were recruited for the study. The reason is that only existing scale that assess teachers' motivation to teach in Turkish language has two subscales; intrinsic motivation and extrinsic motivation. Therefore, neither teachers who have other types of extrinsic motivation and amotivation nor the teachers who have low level of any type of motivation were included to the study. Future research may consider examining the students' motivational process whose teachers have low level of motivation to teach or amotivation.

Secondly, teacher created autonomy support was assessed via students' perceptions of autonomy-supportiveness of the lessons. Future studies may use objective observation tools to assess autonomy supportive structure of the PE lessons instead of using self-report questionnaire to ask students about their perception of autonomy support level of the lesson. In addition, qualitative methods such as interviews with students to understand how autonomy supportive is the lesson might give more insight.

Lastly, this study has cross-sectional design. However, it is important to resolve which PE-specific pedagogical approaches, teaching styles, tasks, drills and activities fostering students' perceptions of autonomy support and basic psychological need satisfaction. Accordingly, experimental evidence that designate these practices is needed to give PE teachers a shortcut guide.

Despite these limitations, the results of the study are interesting and have a contribution to the literature. To conclude, this study revealed that Vallerand's (1997) full model is acceptable in Turkish PE environment. Furthermore, this model is largely similar among students whose PE teachers are intrinsically motivated to teach and extrinsically motivated to teach. If the teacher is intrinsically motivated for his profession, the autonomy support he provides in the lesson reduces his/her students' amotivation level more.

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International Journal of Contemporary Educational Research (IJCER)

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Students' Attitude toward STEM Project-Based Learning in the Fun Cooking Activity to Learn about the Colloid System

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To cite this article:

Imaduddin, M., Praptaningrum, D. N. W., & Safitri, D. A. (2020). Students' attitude toward STEM Project-Based Learning in the fun cooking activity to learn about the colloid system. *International Journal of Contemporary Educational Research*, *8*(1), 14-26. DOI: https://doi.org/10.33200/ijcer.820898

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International Journal of Contemporary Educational Research
Volume 8, Number 1, March 2021, 14-26 ISSN: 2148-3868

Students' Attitude toward STEM Project-Based Learning in the Fun Cooking Activity to Learn about the Colloid System

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Abstract

This research revealed how the implementation of STEM Project-Based Learning (STEM PBL) in chemistry teaching on colloid system topics with heterogeneous groups of students in terms of habits, hobbies, goals, and gender-biased perceptions. Also, the research described students' attitudes towards STEM PBL, and the linkages between their attitude and understanding. Participants consisted of 101 students of high schools. Qualitative data were obtained through documentation, and narrative responses in group reports. Quantitative data were obtained through the questionnaire of students' attitudes toward STEM PBL and the comprehension tests. There are nine types of food products as STEM projects. The most frequent positive experience is that learning colloid topics is "fun", while the most frequent negative experience response is "time-consuming". The average score per item of attitude is higher in (1) the female's group, (2) the group who is used to cooking, (3) the group who has a passion, (4) the group who has a goal, and (5) groups that have gender-biased perceptions. There is no significant difference in attitude scores in the student group, except that the group with goals in the culinary field has a higher average attitude score than the group who have no aspirations. Students' understanding is not closely related to the attitude.

Keywords: Students' attitude, STEM Project-Based Learning, The fun cooking activity; Colloid system

Introduction

The development of science and technology in the last few years has increased the need for cooperative, collaborative, creative, and innovative individuals who can work in groups. The right way to do this is through education (Batdi, Talan, & Semerci, 2019). In these conditions, STEM (Science, Technology, Engineering, and Mathematics) as an interdisciplinary approach, which becomes a priority, is increasingly urgent to develop lifelong learning skills (B. Yildirim & Altun, 2015). The perceived potential of STEM is to fulfill students' learning experiences by assisting them in the ability to transfer classroom learning to the real world. Students can solve new problems and draw conclusions based on previously learned principles applied through science, technology, and engineering, and mathematics (Roberts, 2012). STEM leads to the practice of theoretical knowledge into a variety of products and findings that enhance students' innovative and productive skills (Morrison, 2006). The various problems faced by the global community are increasingly developing, requiring a multidisciplinary point of view, and the integration of STEM concepts to solve them. The STEM discipline and its role have a significant influence on solutions to problems of everyday life (Gülen, 2019). Meaningful learning with the STEM approach can be achieved by building a link between what is learned and real-life (Yalçin, Kiliç, & Atatay, 2016).

STEM is an educational approach that equips students with the ability to work together, systematic thinking, effective communication, thoroughness and curiosity, creativity, and problem-solving skills (Bybee, 2010; Dugger, 2010; Seage & Türegün, 2020). Although educators recognize the importance of STEM education, neither educators nor researchers consistently agree on and understand how to implement STEM at the secondary school level (Wang, Moore, Roehrig, & Park, 2011). Currently, STEM teaching is taught separately in each subject. Therefore, teaching STEM with an integrative point of view from various disciplines still needs to be developed and implemented by educators and researchers. Educators should be able to design appropriate project-based learning (PBL) strategies to increase students' interest in learning, and further facilitate the

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development and improvement of students' skills for their future (Tseng et al., 2013). The implementation of STEM PBL in various subjects in the school curriculum is a challenge to be developed.

There are different definitions and approaches to STEM in the literature. However, the similarity of these definitions and approaches is that STEM is an interdisciplinary approach and is implemented in a real-life context (Srikoom, Faikhamta, & Hanuscin, 2018). Not all students in the future will focus on activities formulating face creams, solving hydrocarbon problems, riding rockets, or specific things in the scientific field, but they certainly have and will be involved in their daily life with cooking activities, whether done personally or found in their daily lives (Grosser, 1984). Science and cooking have been developed into an interdisciplinary endeavor aimed at using food and cooking to teach chemistry, physics, and biology. Food and cooking can be a medium for collaboration across diverse groups, from collaborations between scientists and chefs to collaborations with the general public, students, instructors, and specialists in other academic fields, be it in science or non-science (Sörensen & Mouritsen, 2019). Cooking activities as a project in the teaching process are interesting to be developed because of the high opportunity to be applied in student's daily life. Cooking can demonstrate a concept inseparable from early STEM education. Cooking can be a deliberate and complex way to increase children's natural curiosity. Cooking is an activity that is accessible, relatable, memorable, and, most importantly, sustainable at home and daily. This makes cooking an excellent means of introducing and depicting scientific principles more closely (Colella, 2020).

Chemistry in the cooking process shows how chemistry is so close to the individual to the students. This activity also shows students that they practice chemistry every time they prepare food each day. Cooking activities are also simple experimental activities that can be carried out with minimal supervision. In the process of cooking with recipe guides, learners practice organizing scientific directions (Grosser, 1984). The environment (in this case the kitchen) is the largest laboratory and learning system imagined (Eshiet, 1996). The laboratory is a scientific work-place such as teaching, learning, practicing practical skills, finding new ideas, designing, and testing prototypes in engineering. Hayward (1992) revealed that the kitchen is a place filled with quality ingredients and is perhaps the safest chemical laboratory in the world. Jacobsen (2011) showed that the use of non-laboratory spaces in schools, such as rooms that are homey, can make chemistry accessible to all and more connected to every student's daily life. Other findings suggest that educators should help students synthesize multiple disciplines because interdisciplinary thinking does not emerge on its own. Cooking activities create a challenging integrative context for teaching chemistry, and offer new possibilities for teaching chemistry in a new learning environment, which goes beyond the chemistry laboratory (Nuora & Välisaari, 2019). One of the topics of chemistry that are closely related to cooking and food activities is the colloid system. The food that is produced generally exists in a colloid state as emulsions, foams, gels, and dispersions. Therefore, the study of food colloids is an important fundamental field of research activity in the field of food science and technology (Dickinson, 2015). Food colloids provide structure, texture, and taste in the mouth for various food products; for instance, mayonnaise, jelly, bread, jam, ice cream, etc. Food colloids contain hydrocolloid components providing thickening, gelling, emulsifying, and stabilizing characteristics in food products (J. Milani & Maleki, 2012).

This research is interesting because it turns cooking into a process in STEM Project-Based Learning. Cooking is an activity that is not carried out by all students in their daily lives, and is still associated with activities that are considered gender-biased in some cases (Mills, 2010; Neuman, Gottzén, & Fjellström, 2017; Pierce, 2010). Hands-on activities that are close to everyday life can be less challenging and do not provide valuable experiences for learners. This research is important to show whether the cooking project is appropriate to be implemented in heterogeneous classes. This is especially related to the cultural tendency to view cooking as an activity that is identical to women's daily work. This research revealed how the implementation of STEM PBL in chemistry teaching activities on colloid system topics with heterogeneous groups of students in terms of habits, hobbies, goals, and gender-biased perceptions in cooking activities. This research also described students' attitudes towards STEM PBL, and relates it to the understanding of the topic of the colloid system. Students' attitudes towards STEM PBL refers to how students think and feel about STEM and how they involve themselves in the learning process through PBL, which is a fun cooking activity. This condition is characterized by three main components, namely cognitive, affective, and behavior, which are organized towards STEM. Attitudes, in this case, reflect how students evaluate chemistry lessons about colloids and the learning environment for cooking activities, as well as how they react effectively to these learning (Han et al., 2014). Students' attitudes towards STEM are key factors that affect student motivation to study STEM subjects and overtake STEM careers (Maltese & Tai, 2011). STEM PBL is based on engineering designs that direct students' compartmentalized knowledge in science, technology, and mathematics to solve real problems in everyday life. The cooking activities presented in this research provide a simple description of learning that does not require complex technology, but is still oriented towards learning with a STEM approach and is project-based.

Research Questions

1) How is the implementation of STEM PBL in chemistry teaching activities on colloid system topics with heterogeneous groups of students in terms of habits, hobbies, goals, and gender-biased perceptions in cooking activities?
2) How are students' attitudes towards STEM PBL, and the relationship between attitudes and understanding the topic of the colloid system?

Method

Research Design

This research is action research implementing STEM Project-based learning in the classroom. This research was conducted on learning chemistry subjects about the topic of Colloid in 11th grade of high schools with the Indonesian national curriculum. The research was located in SMA Negeri 1 Kudus, Central Java Province, Indonesia. The project-based activity is a starting point for exploring the concept of chemistry. The project is the manufacture of processed food products related to the types and properties of the ingredients belonging to the colloid group. Cooking activities are set in groups of 4-5 people and students can explore the types of ingredients, techniques, and cooking products. At the end of the process, students' understanding of the colloid concept was tested through a test and a survey was conducted on their attitudes towards STEM-Project Based Learning.

Participants

Participants consisted of 101 students, namely 37 males and 64 females. Participants also have various perceptions related to cooking activities. The condition of the participants' perceptions in terms of whether cooking is their habit, hobby, or goal. It also reveals how their perceptions are related to the suitability of cooking activities for a certain gender. This condition is shown in Figure 1.

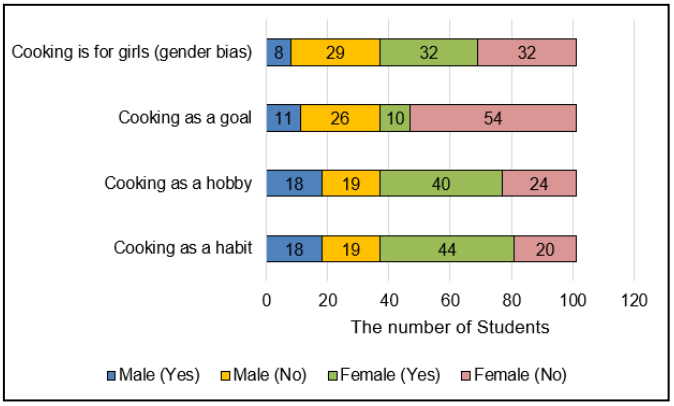


Figure 1. The condition of students' perceptions of cooking activities

Data Collection and Analysis

The research data is in the form of qualitative and quantitative data. Qualitative data showed the students' cooking products, identification of colloid concepts, and students' responses to the learning process. Quantitative data described attitudes towards STEM PBL and students' understanding of the chemistry topic. Qualitative data were obtained through (1) documentation of students' project products, and (2) narrative responses provided in group reports. The analysis of the documentation data used a narrative description of the activity, while the responses were analyzed using the word cloud analysis.

Quantitative data related to attitudes include (1) self-regulated learning; (2) collaborative learning environment; (3) interdisciplinary learning environment; (4) technology-based learning; and (5) hands-on activity. The Questionnaire of Students' Attitudes toward STEM PBL was adapted from Han & Carpenter (2014) by translating and modifying it according to the context of this study. The reliability of the test in the previous

study showed Chronbach's alphas of 0.766 (Self-Regulated Learning), 0.861 (Collaborative Learning Environment), 0.780 (Interdisciplinary Learning Environment), 0.805 (Technology-based Learning), and 0.827 (Hands-on Activity). The overall internal consistency reliability coefficient was 0.871. In this study, the validity and reliability were tested through retesting the modified instruments. The validity of the items used Pearson correlation analysis, while the reliability of the instruments used the Cronbach's Alpha analysis as shown in Table 1. There is one item below 0.334 (r table N = 35) which is 0.314 indicating that one of the items on the ILE scale needs to be improved so that it can be used. In the reliability analysis, each scale has shown a reliable condition > r_{table} (0.334).

Table 1. Instrument Validity and Reliability

Scale	N (items) (r > 0,334)	Cronbach's Alpha
Self-regulated learning (SRL)	5	0.806
Collaborative learning environment (CLE)	5	0.740
Interdisciplinary learning environment (ILE)	4	0.674
Technology-based learning (TBL)	5	0.779
Hands-on activity (HA)	5	0.870

Attitude data analysis was carried out using descriptive statistics by showing the condition of students' attitudes based on gender groups, cooking habits, cooking hobbies, culinary goals, and gender-biased perceptions of cooking activities. Furthermore, the significance of differences in attitudes of each group was analyzed using the Mann-Whitney U test analysis.

Quantitative data in the form of students' understanding were obtained using the comprehension tests related to (1) explain the concept of the colloid system through various examples in everyday life, (2) classify the colloid system, (3) describing the properties of colloid, (4) identify hydrophilic and hydrophobic colloids, (5) describe the colloid production process, and (6) explain the application of colloid concepts in everyday life. The comprehension test consists of 30 multiple choice test items covering all of these indicators (maximum score= 30). The validity of the test is based on the validity of the content which is based on basic competence following the curriculum, and is linked to the STEM PBL context. An example of a comprehension test is shown in Figure 2. The reliability test results showed the Cronbach Alpha coefficient (r = 0.631)> r_{table} (0.244, N=60) so that the comprehension test is in a reliable condition. Testing the relationship between attitudes and understanding of the colloid concept was carried out using a non-parametric correlation test, namely the Spearman Rank test.

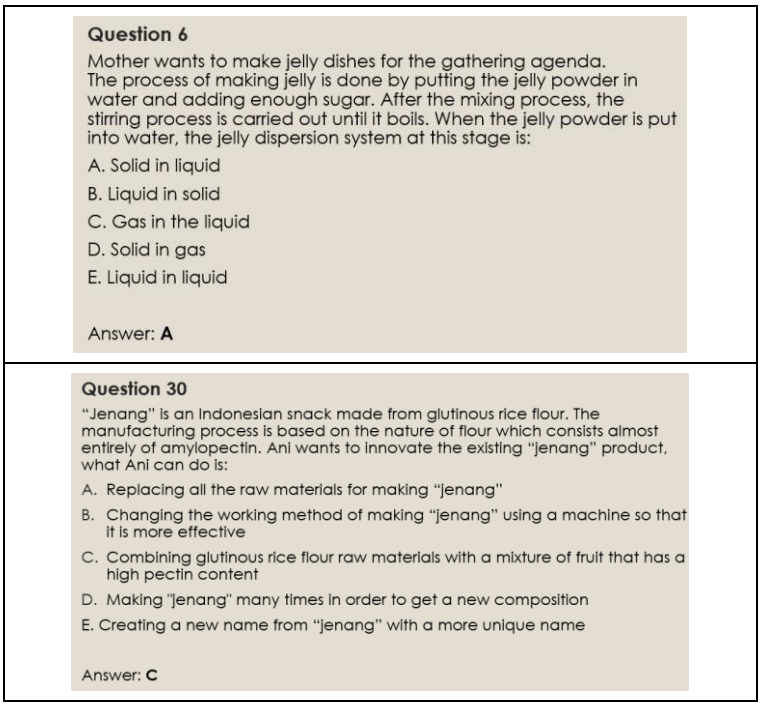


Figure 2. The comprehension test on colloid topics linked to the STEM PBL context

Results and Discussion

Students' product in STEM Project-Based Learning

There are nine types of products selected to be made in the STEM project from 23 groups as shown in Table 2. Also, a picture of the teacher and one of the groups is shown in a fun cooking activity. These products can identify the chemical aspects of colloids.

Table 2. Students' products and colloid identification according to the topic of chemistry subjects

No	Students' product	Identification of the colloid system	No	Students' product	Identification of the colloid system
1	 Macaroni schotel	(1) Emulsion: milk (2) Solid Emulsion: cheese and margarine	6	 Carbonara Spaghetti	(1) Emulsion: milk (2) Solid Emulsion: butter and cheese
2	 Donut	(1) Solid foam: bread (2) Emulsion: milk (3) Solid Emulsion: butter and margarine	7	 Pudding	(1) Emulsion: milk (2) Gel: jelly
3	 Burgers	(1) Solid foam: bread (2) Emulsion: mayonnaise (3) Solid Emulsion: cheese and margarine	8	 Dawet (*One of the Indonesian snacks*)	(1) Emulsion: coconut milk (2) Gel: dawet
4	 Toast	(1) Solid foam: bread (2) Emulsion: milk (3) Solid Emulsion: margarine (4) Gel: fruit jam	9	 Fruit salad	Emulsion: mayonnaise and milk
5	 Ice cream	Emulsion: coconut milk and sweetened condensed milk		 The teacher and one of the groups in a fun cooking activity	

Students' Responses to The Learning Process

Each group was asked to write down the results of their discussion regarding responses to STEM PBL learning through cooking activities. The results were then coded, recapitulated, and analyzed using the word cloud analysis. From the analysis, it can be shown how far each group has had positive or negative experiences in learning. The most positive experience that dominated the responses is that learning colloid topics is "FUN", while the most frequent negative experience response in the group is "TIME CONSUMING". The details of the analysis results are shown in Figure 3. Positive experiences dominate more than negative experiences of students.

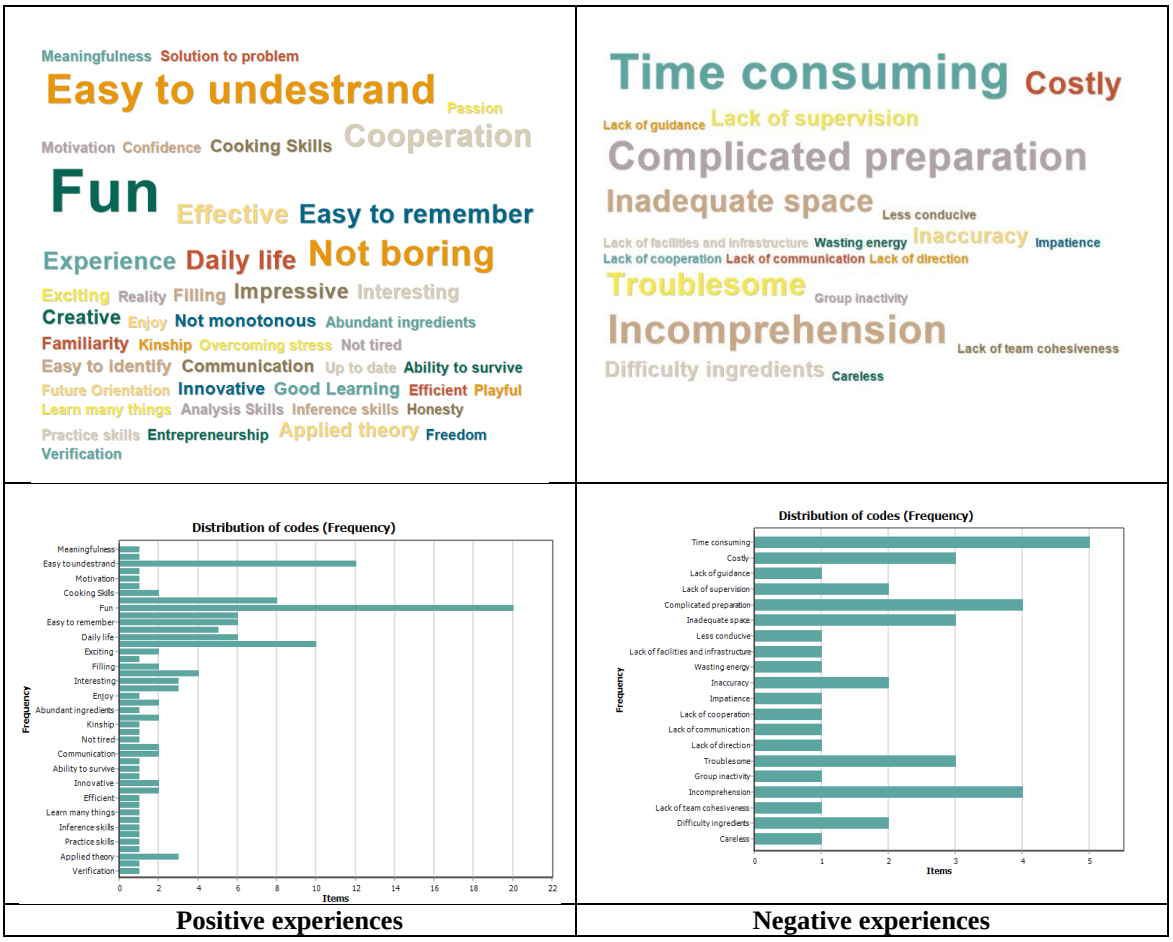
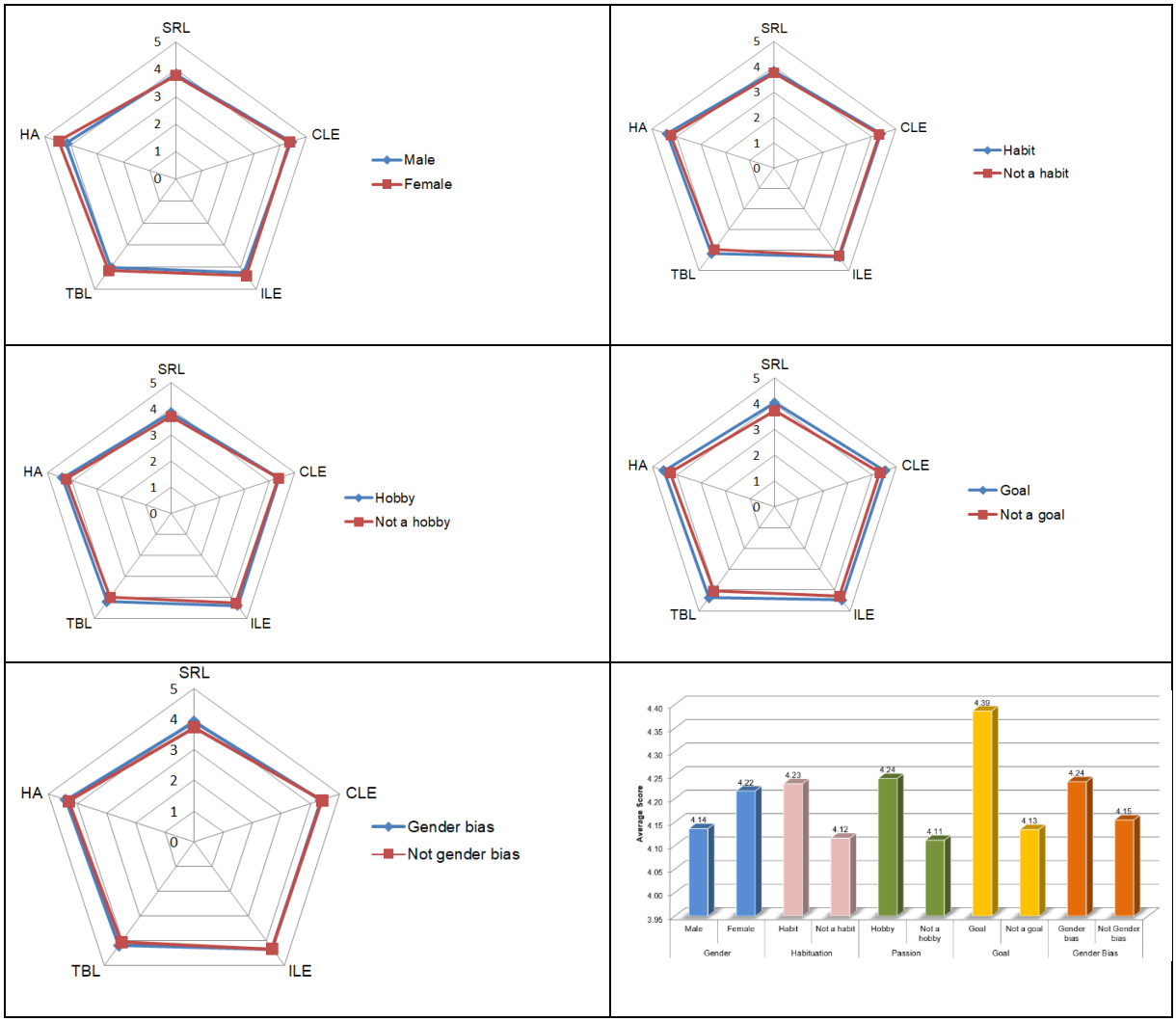


Figure 3. Word cloud analysis of the learning experience of group students based on their reports.

Students' Attitude toward STEM-Project Based Learning

Student groups are categorized based on gender, cooking habits, cooking hobbies, culinary goals, and gender-biased perceptions of cooking activities. These five factors are assumed to influence attitudes towards cooking activities in the STEM project on the topic of colloids. The results of the analysis of attitudes are shown descriptively as in Figure 4.



Note: SRL = Self-Regulated Learning; CLE = Collaborative learning environment; ILE = Interdisciplinary learning environment; TBL =Technology-based learning; HA = Hands-on activity

Figure 4. Descriptions of Student Group Attitudes Based on Categorization (1) Gender, (2) Cooking habits, (3) Hobby to cook, (4) Goals in the culinary field, and (5) Gender bias perceptions in cooking activities.

Figure 4. shows the average score per item is higher in (1) the female's group, (2) the group who is used to cooking, (3) the group who has a passion for cooking, (4) the group who has a goal in the culinary field, and (5) groups that have gender-biased perceptions. Based on these results, it is necessary to carry out further analysis to determine whether there are significant differences in attitudes in each of these groups of students. The results of the analysis using the Mann Whitney U Test are as shown in Table 3.

Overall, the students' average attitude per item was above 3.00 which indicates a good attitude towards STEM PBL. There is no significant difference in attitude scores in the student group, except for groups who have and do not have goals in the culinary field. The group with goals and aspirations in the culinary field had a higher average attitude score than the group who had no aspirations.

Table 3. Descriptive Analysis of Students' Attitudes towards STEM PBL and the Significance of the Differences in Each Group

Scale	Score Average per item (SD)										Score Average per item (SD) based on all items
	Gender		Habituation		Passion		Goal		Gender Bias		
	Male (N=37)	Female (N=64)	Habit (N=62)	Not a habit (N=39)	Hobby (N=58)	Not a hobby (N=43)	Goal (N=21)	Not a goal (N=80)	Gender Bias (N=40)	Not Gender Bias (N=61)	
SRL	3.83 (0.89)	3.78 (0.84)	3.83 (0.82)	3.75 (0.92)	3.86 (0.81)	3.72 (0.92)	4.04 (0.73)	3.74 (0.88)	3.91 (0.86)	3.73 (0.85)	3.80 (0.86)
CLE	4.41 (0.80)	4.35 (0.86)	4.40 (0.77)	4.32 (0.93)	4.38 (0.84)	4.35 (0.83)	4.53 (0.73)	4.33 (0.86)	4.35 (0.92)	4.38 (0.78)	4.37 (0.84)
ILE	4.24 (0.76)	4.38 (0.67)	4.35 (0.71)	4.30 (0.71)	4.38 (0.71)	4.26 (0.71)	4.48 (0.68)	4.29 (0.71)	4.33 (0.70)	4.32 (0.71)	4.33 (0.71)
TBL	4.01 (0.89)	4.15 (0.84)	4.18 (0.81)	3.97 (0.93)	4.19 (0.81)	3.98 (0.92)	4.35 (0.75)	4.03 (0.88)	4.19 (0.82)	4.04 (0.89)	4.10 (0.86)
HA	4.20 (0.82)	4.47 (0.71)	4.40 (0.73)	4.24 (0.84)	4.41 (0.73)	4.25 (0.84)	4.53 (0.61)	4.29 (0.81)	4.41 (0.77)	4.30 (0.78)	4.34 (0.78)
Student's attitude toward STEM PBL	4.14 (0.86)	4.22 (0.83)	4.23 (0.80)	4.12 (0.89)	4.24 (0.80)	4.11 (0.88)	4.39 (0.72)	4.13 (0.86)	4.24 (0.84)	4.15 (0.84)	4.19 (0.84)
	Asymp. Sig. (2-tailed)										
	0.288		0.126		0.136		0,016*		0.312		

The Relationship between Students' Attitudes and Understanding of Colloid Chemistry Topics

The average comprehension score (± SD) is 24.1 (± 2.5), with a minimum score achieved by students of 14 and a maximum score of 28. Based on the comprehension score on colloid topics, the relationship is analyzed with attitudes on students' attitudes towards STEM PBL as shown in Table 4.

Table 4. The relationship between students' understanding and attitudes toward STEM PBL

Scale	Correlation Coefficient	Sig. (2-tailed)	Level	Significance
Self-regulated learning (SRL)	0.043	0.669	Very weak	Not significant
Collaborative learning environment (CLE)	-0.04	0.692	Very weak	Not significant
Interdisciplinary learning environment (ILE)	-0.008	0.935	Very weak	Not significant
Technology-based learning (TBL)	0.064	0.524	Very weak	Not significant
Hands-on activity (HA)	-0.117	0.243	Very weak	Not significant
Attitude toward STEM PBL	-0.009	0.925	Very weak	Not significant

The results show that the condition of the relationship is very weak and it is not significant between students' understanding and attitudes towards STEM PBL. Students' understanding is not closely related to the attitude in the learning process. However, it is known that there is a positive relationship between students' understanding and attitude aspects, namely SRL and TBL.

Discussion

STEM PBL in The Fun Cooking Activity to Learn about the Colloid System

Cooking activities were chosen in the study of colloid topics because colloid systems are found in many components of food. Colloid systems are a type of heterogeneous mixture in which one part is consistently distributed to other parts. This system is formed when there is the dispersion of one part through another but does not mix to form a solution (J. M. Milani & Golkar, 2019). Foods that are mostly consumed by humans are usually in the colloid phase in the form of emulsions, foams, and dispersions (Dickinson, 2015; J. M. Milani & Golkar, 2019). The white foam in eggs is an example of a simple colloid system. This system has a dispersed phase which is air bubbles that are in the dispersing medium, namely egg whites, to produce foam.

Cooking is a complex depiction of art, especially the science behind the process, which depicts molecules that interact with each other and create a combination of taste and texture (Tkacik, 2010). Chemistry related to cooking activities, specifically the analysis of culinary recipes, is very appropriate to introduce chemistry to students who have neutral or negative attitudes towards science (Grosser, 1984). Previous studies revealed how students' knowledge of chemistry can create interesting dishes and fun activities. The students not only succeeded in applying the principles of chemistry in serving unique dishes, but they also demonstrated that the chemistry behind them perfected the dish (Tkacik, 2010). In learning about the topic of colloids, kitchen chemistry aims to change traditional learning, in which students are taught to memorize and recite information, into a classroom-based on experimental activities. Kitchen chemistry aims to create innovative science resources that make science teaching easier for teachers and more fun for students (Nja & Neji, 2013). The various activities and resources in the kitchen encourage collaborative learning and team building (Nja & Idoha, 2013; Nja & Neji, 2013). Teaching by utilizing kitchen resources makes students more active in learning situations and teaching chemistry topics. Students take ingredients for cooking from home and bring them to the classroom. The existing activities, although spending more time than conventional learning, provide a pleasant experience for students, and make it easier for them to understand memorization material on the topic of colloid chemistry. In the cooking process, students' mathematical abilities are also tested in determining the ratio of ingredients in processing, quantitative measurement of food ingredients, and unit conversions for measuring mass and volume of ingredients. The active participation of students and the use of familiar materials can increase understanding, as well as opportunities for entrepreneurial potential (Nja & Neji, 2013). As with the results of this research, previous research has also shown that through cooking activities, students were motivated and enthusiastic, and provided positive feedback (Nuora & Välisaari, 2019). Students consider the implementation of STEM PBL in groups as a positive thing. Students also revealed that the implementation of STEM PBL sometimes creates confusion so that it requires good planning and careful preparation, even though according to some students in this research that is so troublesome. Students adopt the view that the implementation of STEM PBL can be used for various other materials because the application of STEM PBL is very useful and fun to be able to learn by doing and experiencing (Akdağ & Güneş, 2016).

Cooking activities, of course, do not only involve students' knowledge of colloid topics. Other knowledge related to technological, engineering, and mathematical aspects also played a role in the completion of this project. Several studies indicate that the low STEM score is due to the lack of students' ability to put STEM concepts in context and apply their knowledge in everyday life (Hahn, 2017). The kitchen is a virtual laboratory for exploring all kinds of STEM topics, such as measurement, patterns, properties of matter, cause and effect, and many other topics (Bright Horizons Education Team, 2020). STEM integration is teaching with an interdisciplinary approach that removes the boundaries between science, technology, engineering, and mathematics (Wang et al., 2011). The framework in presenting colloid topic learning through cooking activities that shows the relationship to each STEM aspect is shown in Figure 5. Cooking & preparing food are part of everyday life which means life learning takes place in a natural context, and for some students, it becomes more enjoyable because it gets delicious results and makes them full. Cooking, furthermore, is a necessity to survive to serve diversified food for daily needs. This research is interesting with the choice of various types of dishes that are freely made by students.

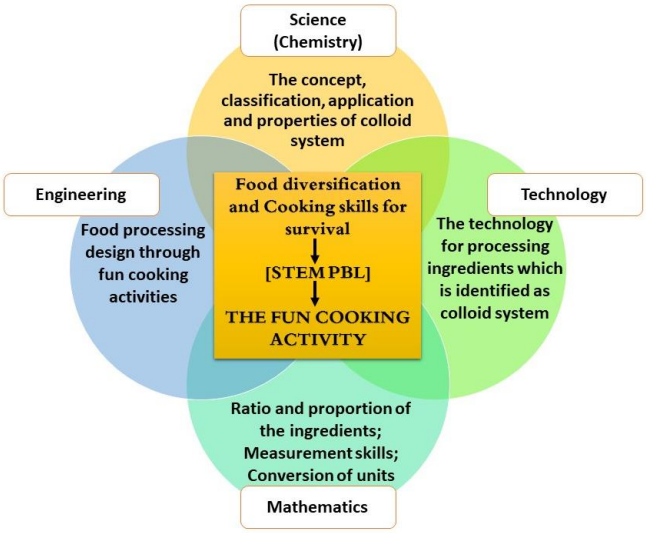


Figure 5. The Framework of The Fun Cooking Activity as STEM-Project Based Learning

Project-Based Learning (PBL) is a student-driven process, while the teacher acts as a facilitator. PBL focuses on problem-solving. In this case, it is a project to process food ingredients including the colloid system phase for survival and daily life. This is different from traditional approaches which tend to be teacher-centered and controlled. In PBL students are no longer motivated externally, PBL gives students autonomy in doing work individually or in groups (Habók & Nagy, 2016). The implementation of PBL through a series of stages as developed by various previous researches (Hidayah & Belajar, 2017; Widarti, Rokhim, & Syafruddin, 2020). The research implemented a STEM approach using project-based learning model stages. PBL is grouped into three main stages, namely (1) Skill competency debriefing, including the formulation of expected learning outcome, understanding the concept of teaching material, skill training; (2) Project work, including designing the project theme, marking the project proposal, executing the tasks of projects; (3) Evaluation, including presentation of the project report (Jalinus, Nabawi, & Mardin, 2017). In this research, the steps were modified from the simple stages that have been developed by Meli (2020) consisting of the main stages, namely (1) Launching STEM PBL; (2) STEM PBL Monitoring; and (3) Evaluating STEM PBL. The details of the activities per stage can be described in detail as shown in Figure 6.

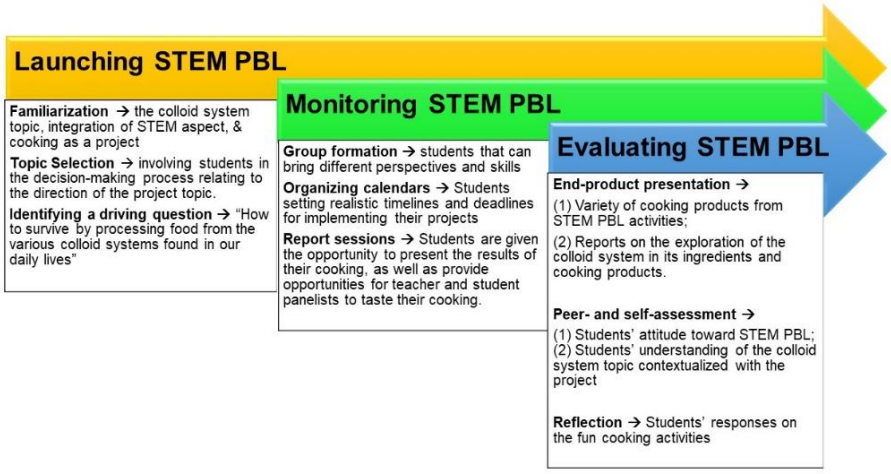


Figure 6. The Stages of The Fun Cooking Activity as STEM Project-Based Learning

Students' Attitudes toward STEM PBL and The Relationship between Students' Attitudes and Understanding of Colloid Chemistry Topics

Even though cooking is a great activity to teach chemistry with the STEM PBL approach, teachers also need to pay attention that this cooking activity is related to habits, hobbies, student future orientation, and culturally there is still a chance for gender bias in this activity. Daily cooking activities are still associated with the role of women at home (Fürst, 1997; Mills, 2010; Neuman et al., 2017; Pierce, 2010). This research showed a more positive attitude in groups of female students, groups of students who are used to cooking, groups of students who have aspirations in the culinary field, and groups of students who still think cooking is more appropriate for women. Even so, a significant difference in group attitudes was shown in groups with future orientation in the culinary field. Thus, it is shown that the attitude toward STEM PBL is closely related to internal factors of students.

Internal conditions related to future goals in the culinary field showed how SRL is in goal setting, planning, and self-monitoring (Puspitasari, Purwanto, & Noviyani, 2013; Santrock, 2011; Schunk, Pintrich, & Mecce, 2008) to achieve what is expected. STEM PBL is certainly a good opportunity to monitor students themselves in the culinary field. This fun cooking activity allowed students to collaborate and contribute to groups. The findings of this research showed different results from previous research which showed that there is no significant relationship between attitudes towards group work and goal achievement orientation profiles, and men are significantly more likely to avoid work than women (Z. Yildirim, 2004). Goal orientation showed differences in attitudes, while gender did not show significant differences. This is like the previous studies related to gender (Karisan, Macalalag, & Johnson, 2019).

This cooking project not only requires students to understand the existing recipe procedures but gives them space to be creative with art (Tkacik, 2010). STEM which is also directed by the integration of art into STE(A)M shows the importance of an interdisciplinary approach (Burke & Danaher, 2018). This project also develops students' abilities to explore learning resources through technology. They can access information via

videos found on the internet to improve their cooking skills. Videos have the opportunity to individually improve the skills of low-skilled students (Glass, 2005). Access to technology learning resources can provide (1) visualization of the cooking process; (2) certainty during the cooking process; (3) replicating the cooking process (4) managing flexible cooking work times; and (5) repeated access to the video if needed (Surgenor et al., 2017). STEM PBL through the fun cooking activities provides opportunities for students to do hands-on activities to understand the concept of colloid chemistry. This activity allows students to gain real experience from the conceptual knowledge they acquire in class (Sutaphan & Yuenyong, 2019). Students can understand how the various types of colloids are in food ingredients that are processed in the cooking process, and get an impression of the usefulness of colloid knowledge in their daily lives to develop a variety of recipes and food products.

This research showed that the condition of students' attitudes and understanding is at a good level after a fun cooking activity. However, this research has not been able to show a significant relationship between the attitudes towards STEM PBL shown by students and their understanding of the topic of the colloid system. This is also relevant to research findings relating to hands-on activities with general performance assessments that have not improved (Pfaff & Weinberg, 2009). However, it was shown that there was a positive relationship between SRL and TBL and student understanding. This provides a direction for improvement in the pedagogical design concerning the design of STEM Project-Based Learning modules in the future. In this condition, students showed their confidence in their potential to learn things related to the topic and the completion of the STEM PBL project. Students also showed ease in finding information related to the field of food processing, as well as the ease of using various technologies in the culinary field, such as rice cookers, toaster machines, mixers, and blenders. Students had a positive attitude towards the development of existing technology and its use in the culinary field.

Conclusion

This research showed the implementation of STEM PBL through fun cooking activities on colloid topics using three main stages, namely (1) Launching STEM PBL; (2) STEM PBL Monitoring; and (3) Evaluating STEM PBL. The implementation showed the various product variants produced by the students with material categories which include emulsion systems, solid emulsions, solid foams, and gels. The implementation of cooking activities was carried out in heterogeneous groups of students by observing it from the aspects of (1) habits; (2) hobbies; (3) goals; and (4) gender bias perceptions in cooking activities. It is known that the most positive response that came from STEM PBL activities is “fun”, while the most frequent negative response is “time-consuming”.

Based on the conditions of the heterogeneous group, research showed that a better attitude is shown by (1) the female's group, (2) the group who is used to cooking, (3) the group who has a passion, (4) the group who has a goal, and (5) groups that have gender-biased perceptions. Although, a significant difference only occurs in the group of students who have different future orientations in the culinary and non-culinary fields. Students with aspirations in the culinary field showed significantly better attitudes. Students’ understanding is also not closely related to attitudes towards the STEM PBL, but a positive relationship can be seen in students' understanding of colloid topics with aspects of students’ self-regulated learning and technology-based learning.

This condition implies that cooking is one of the fun activities that can be implemented to teach science, in this case, chemistry with the STEM approach. Cooking is an activity that involves multidisciplinary studies, although this research focuses more on the topic of chemistry about the colloid system. This cooking activity has not been explored in more depth with other scientific themes. Another limitation of this research is that the variety of activities is not limited to a special pattern, meaning that the use of technology, basic ingredients, and types of processed food products produced by student groups cannot be predicted in advance. This is because it is following the choice of student groups, so that the resulting variety is not as much, or is evenly distributed.

Recommendations

This research verified that cooking activity could be implemented as a STEM project in chemistry teaching. Further designs are needed to implement cooking activities on other chemical topics and across subjects, as well as to increase the level of techniques and technology required in food processing, for example through the implementation of conventional and modern biotechnology in the food sector.

Acknowledgments or Notes

We thank you for the participation of the students of SMA Negeri 1 Kudus, as well as the institutions that have provided support facilities during the research data collection process.

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International Journal of Contemporary Educational Research (IJCER)

www.ijcer.net

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To cite this article:

Guler, E. (2021). A/r/tographic inquiry for the transformation of pre-service art teachers' concept of social justice. *International Journal of Contemporary Educational Research*, *8*(1), 27-53. DOI: https://doi.org/10.33200/ijcer.801804

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International Journal of Contemporary Educational Research
Volume 8, Number 1, December 2021, Page 27-53 ISSN: 2148-3868

A/r/tographic Inquiry for The Transformation of Pre-Service Art Teachers' Concept of Social Justice

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Abstract

This study seeks to enable sophomore-level students in the Department of Art Teaching to make inquiries about their environment and to critically interpret some visuals through a/r/tographic practices. Therefore, it draws on a/r/tographic inquiry, which is one of the art-based research methods. The participants of the study are 13 sophomore-level students (6 female, 7 male students). The data were obtained from reflective diaries, semi-structured interviews and document analysis, and analysed through content analysis. The researcher organized 5 different travel plans for the students in Erzincan, a city located in the Eastern Anatolia of Turkey. The focus trips were made to a shopping mall, a market, a local bazaar, a modern street and an old settlement. The students completed their trips within a period of 10 weeks. The findings of this study showed that the students were able to make critical inquiries about the environment they live in, gained awareness about social issues thanks to the auditory or visual experiences they had in daily life and reflected this awareness to their artistic works.

Key words: A/r/tographic Inquiry, Visual Culture, Pre-Service Art Teachers' Education, Social Justice, A/r/tographer.

Introduction

An increased emphasis on social issues has emerged internationally in the visual arts practices and in art education. This social shift in art education has included a broadening of the field to embrace all areas of visual culture, including folk art, performance, environment, and digital visual technologies, and to consider the range of visual culture forms, media, and processes as having inherent capacities for teaching and learning (Freedman, 2003). Social issues in arts and design education directly help one understand the world. Adults and young people get help of art to convey their own opinions and see it as means of expressing their beliefs, values, attitudes, and ideas on major social issues that affect the world and the environment. Although this is not the primary purpose of arts, arts also seek to explain social movements and personalize social issues. The social perspective of arts education is based on beliefs. So much so that the visual arts education is vital to all societies and cultures. Arts education aims to understand communication, diversity, socio-cultural complexity (Freedman, 2000).

"In the broadest sense, social justice is about equal rights and opportunities for all people in all segments of society. Social justice and the experiences related to it always involve issues on power and social equality" (Anderson 2010, p. 2). According to Watts and Guessous (2006), "A central aim is to articulate the relationship between the collective [struggle] against social ills and the advancement of personal well-being" (as cited in Maguire and Lenihan, 2014). "Social justice education brings together the goals and perspectives of feminist, multicultural, disability rights, environmental, community-based, critical pedagogy, social reconstruction and visual culture art education" (as cited in Garber, 2004, p. 5).

A curriculum of visual arts education focusing on social justice helps students see things in a thoughtful manner, thus developing democratic ways of thinking and becoming informed consumers. Learning about how visual arts affect people can allow children to decide how they allow themselves to be influenced by others. Students

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can learn early on how civic leaders use imagery to represent self and influence people's voting choices. To promote social responsibility, children should begin to learn about the ways in which groups of people are represented in popular culture imagery. Through art education, they can come to understand the damaging effects of visual stereotypes (Freedman & Stuhr 2005; as cited in Stuhr, Morris and Daniel, 2008, p. 93).

The strategy of teaching social justice in arts education can be implemented through both visual and performing arts. In arts education, students are a key component of social justice education, and art provides additional self-expression opportunities for students. Art, whether it is puppetry, dancing and singing or painting and using visual media, offers a distinct means of conveying their ideas and expressing their beliefs on issues related to social justice. In-class strategies used by primary school teachers lecturing on social justice enable students to think about contemporary and historical events critically and creatively. Many of these strategies engage students in multiple perspectives and allow them to develop empathy for those who live at different times, places or cultures. Social justice teachers recognize that it is important to integrate students' hearts as well as their minds into the learning process and to give them opportunities for expressing their thoughts and feelings through role-play, simulations, artwork, and singing. Thus, students are provided with in-depth, challenging, and meaningful learning experiences in their elementary classrooms (Wade, 2007, p. 73).

Students should experience sociological contexts, policies, social movements in history and philosophy and social justice through art in art education (Desai, 2010). Therefore, a/r/tographic inquiry, which is one of the art-based research methods, has been in use to allow students to question life and to experience life-related issues through art.

In recent years, art-based research methods have been popular in art education, and a/r/tographic practices have been particularly included in research methodology (Wilson Kind et al., 2007; Kalin et al., 2009; Irwin et al., 2009; Beer et al., 2010; Richard, 2012; Hannigan, 2012; Irwin et al., 2015). A major shift in academic research began in the 1970s, and by the 1990s, arts-based practices constituted a new methodological genre. This shift is in part the result of work in arts-based therapies. Health care researchers, special education researchers, psychologists, and others have increasingly turned to the arts for their therapeutic, restorative, and empowering qualities (Sinner, Leggo, Irwin, Gouzouasis, & Grauer, 2006; as cited in Leavy, 2015).

> Arts-based research (ABR) inquiry is uniquely positioned as a methodology for radical, ethical, and revolutionary research that is futuristic, socially responsible, and useful in addressing social inequities. By integrating into the arts multiple methodologies along with the post-modern ethics of participative, action- oriented, and politically situated perspectives for human social inquiry, arts-based inquiry has the potential to facilitate critical race, queer, feminist, and border theories and research methodologies (Finley, 2008, p.71).

Epistemologically, ABR assumes the arts can create and convey meaning. "The practice of ABR is based on aesthetic knowing or, as Neilsen (2004) suggests, "aesthetic work." This research approach uses the arts in order to disrupt the ordinary and to stimulate change, transformation, and even transcendence in turn. With respect to the aesthetics or "beauty" of the research product itself, the beauty elicited by ABR is explicitly linked to how it fosters reflexivity and empathy in the viewer (and researcher)" (Barone & Eisner, 2012; Neilsen, 2004; Dunlop, 2004; as cited in Leavy, 2015, p. 26). As an evolving paradigm for research, ABR is also interchangeably referred as Arts informed research, Arts informed inquiry, and Arts based inquiry amongst other subtle variations (Barone and Eisner 2012; Knowles and Cole 2008; Ewing and Hughes 2008; as cited in MacDonald & Hunter, 2018).

The purpose of art-based approaches is to integrate aesthetic concern into research process with the consideration of various components. The reflections of aesthetic and art-based forms on educational research started to be used in 1990s with various approaches such as narration based works, autobiography, art and movement, exploratory and reader theatre, multimedia hyper-text, visual arts, photograph, music, poem, creative interpretation, creative writing, drawing, film, dance, music, visual reading, visual formation, collage and cartoon based approaches, the approaches based on digital art and application, and reflective drawing. This evolvement proved to be useful for researchers (Sullivan, 2010; Leavy, 2015; as cited in Bedir Erişti, 2015). "A/r/tographical work is a specific category of arts-based research practices within education research. A/r/t is a metaphor for artist–researcher–teacher. In a/r/tography these three roles are integrated creating a third space" (Pinar, 2004, p. 9).

A/r/tography, as a new research methodology, is a practice-based approach involving the practices of artists (musicians, poets, dancers etc.), educators (teachers/students), researchers (investigators). It has been

considerably associated with action research. Also, it offers a unique perspective that renders action research into a living practice, a utilitarian approach (Deleuze & Guattari, 1987; Deleuze, 1990; as cited in Irwin, Barney and Golparian, 2016, p. 192). A/r/tography, which combines art and education and presents a living practice, makes it possible to question studies once again by offering an alternative perspective. In this sense, a/r/tographic practices in art education are notable in the relevant literature (Boulton, Grauer and Irwin, 2017; Barney, 2019; Lee, Morimoto, Mosavarzadeh and Irwin, 2019; Marin-Viadel, Camison-Coello and Varea, 2019; Marshalsey and Sclater, 2019; cited from Adams, 2019; Palau-Pellicer, Mena and Egas, 2019). As noted by Barney (2019), who applied a/r/tographic research and practices in art education, applying this method to a number of metaphors and artistic concepts turns a/r/tography into a pedagogical strategy, which functions as a generative artistic concept and metaphor for exploring through various means of course and curriculum design. Furthermore, Nicole Lee, Ken Morimoto, Marzieh Mosavarzadeh and Rita Irwin's (2019) article explored walking as a form of a/r/tography, using three propositions of walking as an artistic enquiry with a focus on how walking and a/r/tography complement each other, since both provide the conditions for lingering with emergence. To improve the curricula, Ricardo Marin-Viadel, Alicia Camison-Coello, and Ana Varea discussed a research project in schools around Honduras where curriculum was developed through participatory action research in the form of an a/r/tographic image dialogue, which is deemed to be an active visual conversation that proved transformative for learners and teachers as well as the researchers. In another research, Lorraine Marshalsey and Maddy Sclater performed an art-based action study based on the life experiences of students. Employing participatory action research, their study focused on students' lived experiences of studio learning in the UK and Australia, and revealed the impact of technology-enhanced learning on meaning-making in relation to student values, and the effect of educational environment on students' engagement, learning and practice, and their creative practice in design education (Adams, 2019). A research by Adrienne Boulton, Kit Grauer and Rita L. Irwin (2016) focused on a/r/tographic practices with pre-service visual art teachers. Their study entitled "Becoming Teacher: A/r/tographical Inquiry and Visualising Metaphor" discussed recent research that explored secondary visual art teacher candidates'/new teachers' processing of visual metaphors to provoke their a/r/tographical inquiry regarding their perceptions on the practice. Another study was conducted by Paloma Palau-Pellicer, Jaime Mena and Olga Egas (2019). Their study entitled "Arts-Based Educational Research in Museums: 'Art for Learning Art', an a/r/tographic Mediation" drew on the a/r/tographic inquiry in museum education.

In Turkey, several a/r/tographic research and practices have been conducted in the last five years. A book edited by the Turkish researcher Bedir Erişti (2016) was published for the purpose of clarifying and popularizing the a/r/tographic inquiry. Güler (2015) transferred music, which is a distinct field of study, to her working field, and conducted a/r/tography inquiry on her paintings, which can be regarded as an original study. In this study which aimed at observing the effect of knowledge on to what extent one's sense of hearing intuitively could develop, George Gershwin's composition Rhapsody in Blue was painted. Coşkun (2017) applied an a/r/tographic research method to a study. Coşkun's study aimed to determine how students realized the process of creating a 'self-history project' in the frame of the artworks created by the participant students, who, throughout the project, made use of their own life experiences, researched into cultural values and historical events, and utilized interdisciplinary relations. Keser and Narin (2017) set out to understand what kind of methodology a/r/tography applies, how it is shaped, and on which research processes an a/r/tographical research is based on. To find answers to these questions, five a/r/tographic articles that described and explained the project in Richmond, Vencouver, Canada, were examined. It is understood that the ultimate goal of a/r/tographic investigations is not to find answers and solutions for research problem and questions, but to form artworks and visual images related to research problem. Additionally, Güneş (2018) explored a/r/tography practices in painting studio art class as an alternative method in training prospective art educators. In this study, a/r/tographic inquiry process in the studio art classes was structured by the students who generated some meanings by means of living inquiry and metaphors. With the help of a/r/tography practices, artist/researcher/teacher-learner identities of the students were revealed. In 2019, a study by Mavioğlu questioned the subconscious effects of visuals, the relational contexts of visuals, and examined the mitigability of subconscious effects through inquiries. The primary method of this study is to find in-depth meanings through experiencing inquiry. In another study by Özcan (2019), the theme of a subjective artistic inquiry was chosen, and the concept of procrastination was examined under an a/r/tographic approach.

Methodology

Research Goal

Addressing social issues through visual arts practices and art education curricula helps students understand the relationships between objects and cultural identities, political actions and extra-curricular activities, circumstances and discourses. This study seeks to enable sophomore-level students in the Department of Art Teaching to make inquiries about their environment and to critically interpret some visuals through an a/r/tographic inquiry. Accordingly, this present study aims to answer the following questions regarding the vicinity of students,

1. What did the students bring to the forefront regarding culture? What did they experience?
2. What did they question regarding this specific culture?
   a) What issues did they question and experience regarding this culture?
   b) How did they perceive and interpret the concept of social justice?
3. How did they reflect the issues they questioned and experienced regarding this culture in their art works?

Research Model

The present study is based on a/r/tography, which is one of the art-based research methods. A/r/tographic research method is a practice-based/art-based form of research in art and education. Alongside other art-based, art-related, and aesthetically defined methodologies, a/r/tography is one of many new research investigations that consider art as a means of re-exploring the world to improve understanding (Springgay, Irwin, Leggo, & Gouzouasis,2008; Springgay, Irwin, & Wilson Kind, 2005). To be engaged in the practice of a/r/tography means to inquire the world through a process of art making and writing while assuming the role of an 'artist (a), a researcher (r), or a teacher (t)' (Springgay, Irwin, & Wilson Kind, 2005). A/r/tography means not trying to look for answers to questions or to offer linear procedures that result in well-thought answers. Rather, it is a form of living inquiry. It is engaged with an ongoing investigation surrounding these questions and aims for a deeper understanding. Relational facts and experiences from one's active engagement are taken into consideration (Wilson Kind, 2006). Rita Irwin (2004) explains that a/r/tography is based on the premise of three realms of knowledge proposed by Aristotle, which are theoria (knowing), praxia (doing) and poesis (making). "Taking on multiple roles as artists, researchers and teachers, a/r/tographers draw attention to where the simultaneous use of languages, images, materials, situations, space and time is meaningful. They create conditions to generate knowledge and understanding through artistic and educational inquiry processes" (Irwin and Springgay 2008, p. 119). Therefore, we can infer that a/r/tography is a research approach involving an existing and living inquiry process by finding and embodying meaning through artistic and literary interpretations and experiences as well as artistic and literary expressions. "While a/r/tography researchers focus on the development and transformation of their research-oriented questions throughout the process, they are competent to make sense of their visual and literary works of art based on their own research questions" (Springgay et al., 2008; as cited in Irwin, Barney and Golparian, 2016, p. 192).

Participants

The participants of the study are 13 sophomore-level students (6 female, 7 male students) attending the course of painting art major workshop in the department of visual arts education. The research was carried out in the 2018-2019 academic year with the participation of students from Erzincan Binali Yildirim University, Fine Arts Education, Department of Art Teaching in Erzincan, a city located in the Eastern Anatolia of Turkey. The study drew on the criterion sampling method for the selection of the participants. "The criterion sampling method studies the cases that meet a set of predetermined criteria. Criterion or criteria can be determined by the researcher or a pre-defined list of criteria can be used" (Yıldırım and Şimşek, 2011, p. 112). One of the criteria of this study is that students should have the knowledge of basic design principles and elements. That is why the participants were selected from sophomore-level. Other criteria include attending the course of painting art major workshop as well as participating in and reporting about focus trip experiences. The researcher organized 5 different travel plans for the students around Erzincan, Turkey.

Data Collection Tool

"A/r/tographic researchers benefit from many qualitative approaches in the data collection process and are mostly concerned with personal stories, memories, and photographs. They can draw on some forms of social sciences (observation, interview, focus group) as well as their own artistic and educational inquiries to collect data in a/r/tographic research" (Irwin, Barney and Golparian, 2016, p. 194). Since a/r/tography is also an approach that allows examination on perceptions, artists can comprehend the power of an image, a performance, and a word, and make connections between them to create different meanings. In this context, a/r/tographer provided the students with structured interview forms and travel instructions during the course. The students collected data from photos, shot videos, made interviews, and prepared reflective diaries covering a period of 10 weeks, using their own perspectives and paying attention to the key points in the instructions.
Reflective diaries: Following each trip experience, the students wrote diaries reflecting their opinions with the addition of both visual images and texts.

Semi-structured interviews: The students were interviewed for once time during this study. They were asked about their trip experiences, the issues they questioned, their research process and their artistic works.

Document analysis: The written and visual documents created by the students during the a/r/tographic project, their artistic works, the short interviews they made during the research, the photos and videos taken by them were used as data for analysis.

Data Analysis

This study used content analysis method for the data analysis, and reception analysis for the interpretation of the visuals. The content of the interviews, field notes and documents are analysed with the use of content analysis method. In this method, the measurement units focus on communication, especially the variety and frequency of the messages, how many times a particular speech pattern or phrase is used. "Content analysis looks for insights in which situations, settings, styles, images, meanings and nuances are key topics" (Merriam, 2009, p. 195). On the other hand, reception analysis is based on the empirically verifiable validity of the actual interpretation of the viewers, audience, or readers in understanding an image.

According to Hall (1980), "Audience do not directly accept the preferred meaning of a text; viewers, on the other hand, form their own meaning regarding the image or imaginary stance they perceive; that is, they are active recipients, not passive recipients" (Duncum, 2016, p. 16). The students received and interpreted the images they encountered in their surroundings, the places they photographed and the artistic works they created in the a/r/tographic process.

Researcher's Role

While designing this study, the researcher drew on the sample practice she participated in the a/r/tographic course led by Professor Rita Irwin at the course of visual research methods in the PhD program in Art Teaching in 2015. In this practice, Rita Irwin asked her PhD students to take three photos, one about the building they were in, one of their own choice, and one associated with education. The students took these photos within the specified time and explained why they took each photo one by one. The students were unaware that they underlined a problem. The photos showed an empty classroom, an empty corridor, a room with old items. These photos made them question the following: "Why are there no students?", "Where are the students in the middle of the educational year?" So, they started to question problems regarding education and students. Professor Rita Irwin enabled them to gain awareness regarding their own thoughts and showed them how a problem arises. Today, the researcher aims to offer a living inquiry process for the students by enabling them to realize the things that went unnoticed in the city where they pursue their education, to inquiry about their own life, and to make sense of the visual culture they are in. Also, the researcher wondered about what the students would question based on their own life experiences and how this process of thinking would transform into an artistic product. Thus, the researcher decided to carry out a particular study by integrating the a/r/tographic inquiry into the course of painting art major workshop in the department of Art Teaching. In the a/r/tographic inquiry process, the researcher embraced the identities of researcher/teacher and artist as follows: Firstly, the researcher explained the key points of the trip experiences by the students and helped them find an idea to question; secondly, she created an opportunity for discussion on issues with the help of her researcher identity and guided the students; thirdly, she evaluated the ideas that the students proposed in relation to art education with the

occasion of her teacher identity, and drew on her artist identity in the process in which the students turned their ideas into artistic products.

The Practical Part of the Research

Figure 1. The Practical Part of the Research

Embracing a perspective of critical pedagogy, the students adopted five travel plans in their close surroundings to reveal a living problem or a problem about life based on what they see in their environment. There was no pre-defined problem or research question. The students decided on a problem or a theme based on their observations in the places they visited, their visual records and reflective diaries. They first took photos to visualize these problems. Then, they wrote reflective texts with the help of these visuals to express their opinions. Among these visuals are images, videos, snapshots, books, book covers, cartoons, art objects, in short, everything they encountered in their daily lives. For some students, the things that they saw during their trips reminded them of some movies; some used art works to design their artistic products whilst others combined their observations and the books they read before. At the end of the process, they created an art form by using their impressions and inferences from the things they had encountered. Making connections between the art forms they created and the themes they identified through their experiences, the students looked at their ordinary lives from different perspectives to produce multi-layered meanings.

Findings and Results

The findings from the a/r/tographic inquiry process are grouped under three themes: Focus group experiences-exploration, through life-realizing and transformation of ideas-creating. These themes represented the students' experiences. As too many visuals were obtained during the trip experiences of the students in the research process, each theme referred to different trip experiences of different students.

Focus trip experiences-Exploring

The students conducted 5 different trips in Erzincan, a city with a multicultural environment in the Eastern Anatolia. They wrote travel notes, took photos, and shot videos by following the instructions given by the researcher before each trip, even interviewed some people in the places they visited and had new experiences.

Through life -Realizing

Based on the observations in each trip, students had an increased level of awareness regarding an issue about the geography and culture of the city they lived in. Social awareness was one of the concepts they referred in their experiences. Writing reflective diaries in each trip, the students made sense of the photos they took and the texts they wrote. Overall, the students followed this process: Trip experience-photographing-taking videos-interview-interpretation-realizing. It was observed that the students repeated this process each time. Following these five

trip experiences, the students made rhizomatic connections between the trips and their experiences. For example, they made semantic-textual and visual connections between their first and fourth trips.

Transformation of ideas-Creating

Based on each event and phenomenon they experienced in the first and second themes, the students identified a problem and turned it into an artistic product.

Focus trip experiences-Exploring

The findings and interpretations on the first research question "What did the students bring to the forefront regarding culture? What did they experience?" are presented under the theme of focus group experiences-exploring. The expressions and phrases that were brought to the forefront under this theme are written in bold letters.

The first trip experience: A local bazaar- Coppersmiths' Bazaar

In this trip experience, the students were provided in the instructions with key points on copper embroidery in the region of Erzincan. These key points were copper embroidery, copper history and Erzincan, copper as craft, cultural values in copper bazaar. The students were asked to capture interesting images. They visited the underground bazaar located in the center of Erzincan, and each of them took photos using their own perspective according to the key points in the instructions. Some of them interviewed the copper masters to obtain information, while some had hands-on experience with copper embroidery.

Figure 2. The trip of Tarık to the Copper Bazaar and his experiences

Tarık evaluated copper embroidery in his reflective diary as follows:

> "*Our Traditional Turkish Handicrafts* are a rich mosaic made up of the cultural heritage of various civilizations with thousands of years of history in Anatolia. Each of our traditional handicrafts have a cultural value. Some of our handicrafts have both *cultural and have economic value*, and allow us to contribute to our national economy by marketing them both in the domestic and foreign markets. The only way to hand down our handicrafts, the treasures of our culture, to *the next generations* as an heirloom is to protect, preserve and refine them. Some masters, albeit few, in Anatolia are in effort to carry on *the profession of coppersmith.* The master, who meticulously draws Seljuk *and Ottoman motifs on* copper products such as pitcher, churn, oil lambs and plates, etc., stated that the profession of coppersmith is looked down" (Tarık, personal communication, November 2, 2018).

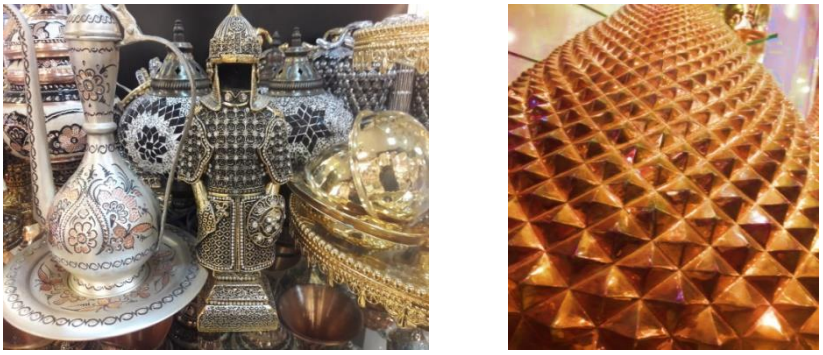

Figure 3. The trip of Salih to the Copper Bazaar and his experiences

Salih obtained information on copper embroidery and interpreted the visuals in a cultural sense in his reflective diary as follows:

> "When we analyse how this is made and consider the techniques in a theoretical way, we can say that *mostly stylized tulip, leaf, flos granati, cypress motifs, animal figures, geometric shapes* are used... As seen in the photos, they are an indispensable part of the life, omnipresent in our daily lives. So much so that *the Alevi culture, the football logo in the axis, the portrait of Atatürk, and the Ottoman coin*, these are all *the values of our society*; in short, copper tells us about us" (Salih, personal communication, November 2, 2018).

Figure 4. The trip of Inci to the Copper Bazaar and her experiences

Inci experienced copper embroidery in this trip and explained the reasons for lack of interest in copper embroidery today as follows:

> "I experienced *copper embroidery* with the help of Master Erdal in the copper bazaar, whom I visited to experience this embroidery art and to explore copper embroidery. It was very difficult to do it. Because it was difficult to work with an iron tool on a hard copper plate… *Technological* age is the reason why coppersmith, which has been a part of their lives for many years, is not valued as much as it once was… And today's generation does not have an interest in *art and craftsmen* in such a technological age… "(Inci, personal communication, October 21, 2018).

The second trip experience: A trip to the market

In this trip experience, the students were provided with the following key points in the instructions: Give your opinions on the bazaar culture, and its economic, social, and environmental dimensions, people's behaviours, visual and auditory images and situations in the bazaar. The students were asked to capture interesting images based on these key points, and to comment on them.

Figure 5. The trip of Mahmut to the bazaar and his experiences

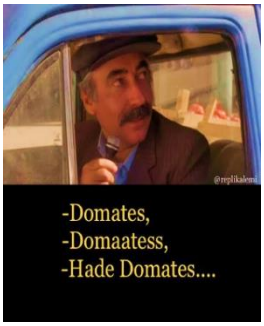

Figure 6. Züğürt Ağa Movie

Mahmut included a snapshot from a Turkish movie in his reflective diary (See Figure 6), establishing a link between the movie and the bazaar life, and visualized the struggle of people's life through humour as follows:

> "District bazaars, which create the historic fabric of *the shopping culture*, still survive today against the tens of thousands indoor shopping malls in Turkey, maintain their dynamism and the shopping tradition as well. District bazaars are the temple of the *street shopping culture* and contain all kinds of sounds, colours, and smells, making them a place visited by people of all ages. Bazaars contribute to *social cohesion and national consciousness.* In bazaars, producers display their products. This prevents unfair competition and allows for *a fairer sales system*. Sellers initiate their products by shouting slogans, *singing songs, promote* their sales by *folk songs and chansonnettes,* which is an integral part of *the bazaar culture*. Amidst the sellers shouting, 'If I had money, I would buy it', 'Come sister, choose, and buy; if you do not, you will regret it, and if you do, you will feel lucky,' one may experience sweet and fun back and forths" (Mahmut, personal communication, November 28, 2018).

Figure 7. The trip of Tarık to the market and his experiences

Tarık established a link between his trip experience and the book he was reading, and highlighted issues such as producer-consumer, labour-effort, oppressing-oppressed from a different perspective as follows:

> "Everyone in a bazaar is a consumer; indeed, there is no producer. For example, the book I am reading 'A*nimal Farm by George Orwell'* on animals tells us about how *passive* people are and explains that people *dominate* everything without producing anything… This trip experience enabled me *to look differently* even to an ordinary bazaar shopping" (Tarık, personal communication, November 4, 2018).

Figure 8. The trip of Inci to the bazaar and her experiences

Inci described what she experienced in the bazaar and expressed her opinions by drawing attention to large differences in living standards as follows:

> "One of the sellers in the bazaar, who was cooking and selling what he cooks on a stall in a corner, caught my attention. He graduated from the Department of Physical Education and Sports Sciences five years ago. As he could not be appointed as a teacher by *the Public Personnel Selection Examination*, he currently made his living by selling chicken sandwiches in the bazaar. I realized that the seller selling potatoes in the visual was doing something different with potatoes. He brought a gas cylinder and put it in the front of his stall, and boiled potatoes in pots. I was very surprised to see it, since I had never seen such a thing in a bazaar. …There were *many women* selling different stuff in the market. One of the photos (See Figure 8) shows the old woman sellers in the bazaar. They reproach people for selling these *natural products* (mulberries, apricots, dried fruit roll-ups, dried apples etc.) they produce in their fields "(Inci, personal communication, November 3, 2018).

The third trip experience: Shopping mall

In this trip experience, the students were provided with the following key points: Compare the things you encountered and observed in your previous trips. Express your ideas on people's behaviours, consumption, and human factor in the shopping mall, and take photos of the things that attract your attention and try to determine the strategies that are used to promote consumption.

Figure 9. The trip of Zehra to the shopping mall and her experiences

In her reflective diary, Zehra explained how people become consumption monsters in the capitalist system and how this system affects our lives as follows:

> "With the rise of *the consumption culture*, leisure time no longer means *free time or* spontaneity; rather, it is a time full of unnecessary consumption. It is a pity that people visit shopping malls at the slightest opportunity and spend their time alone, or with their friends or children there…Shopping malls… Consumption frenzy… As for children, they always need to run and move regardless of their age. Some parents think that they make their children feel happy when they take them to the shopping malls; yet, this is a big misconception. Children should run and play not on the marble and stone floors of malls, but on natural ground, soil, grass… Where we stand now is unfortunately an indisputable victory of *capitalism.* It has such a great impact and control on our lives that it *enslaved us and turned us into consumption monsters* by using every means available to it" (Zehra, personal communication, December 9, 2018).

Figure 10. The trip of Feride to the shopping mall and her experiences: "Game is the beginning of the fine arts"

In her reflective diary, Feride reported that she realized the strategies used by shopping malls to encourage people to spend more time in shopping malls. She semantically interpreted every visual and colour she saw as follows:

> "Shopping malls attract us to trap us. As it never gets dark inside shopping malls, one cannot understand how time passes… Research demonstrates that *colours and symbols influence people*, particularly when it comes to consumption. For example, bright orange attracts attention and is appetizing; it is thus used at sales points and fast-food venues. Also, yellow is used for attention or warning. For instance, the yellow-black combination is often used as a stimulant on the walls of car parks. The blue-green combination means hygiene and health *at the sub-conscious level"* (Feride, personal communication, December 7, 2018).

Figure 11. The trip of Salih to the shopping mall and his experiences

Salih commented on sales policies and visual perception management in his reflective diary as follows:

> "Today, *advertising* has turned into a fast-developing sector. Everything from *digital signs to posters, from big billboards to magazines* have become colourful. So, there are large and small posters in every shop, which causes *visual pollution;* this being the case, shopping malls also do the same… Another *sales strategy* is giving '20% discount to any customer who takes a picture in front of this image and shares it on social media with the address.' That is, the seller promotes his/her products for free through someone else who shares it online, and then the customer has 20% discount thanks to his/her social media account that s/he uses every day. There are also some shops that give their customers a free cup of Turkish coffee when they share their location, etc…The old men and women who set up their stalls early in the morning in the coppersmiths' bazaar or markets are very different than these neat people in shopping malls, but they are not as sincere as bazaars. *Bazaars* bring together the public by offering sincere conversations and keeping the culture together… Yet, shopping malls are based on *herd mentality* as the goods are sold at fixed price" (Salih, personal communication, December 9, 2018).

The fourth trip experience: Ordu Street- A modern settlement

In this trip experience, the students were asked to analyse the key points in the city center, including architectural buildings, art spaces, commercial buildings, cafes, shops, etc.

Figure 12. The trip of Filiz to a modern settlement and her experiences

In her reflective diary, Filiz expressed her opinions on the architectural structure of the city, which was reconstructed after the earthquake, as follows:

> "A new city was born out of the ruins of the *earthquake*. It would not be an overstatement that Erzincan was born out of its ashes. The biggest earthquake in Erzincan occurred on December 26, 27th, 1939. This 7.2 magnitude earthquake unfortunately cost the lives of nearly 33 thousand people… The buildings reconstructed after the 1939 and 1992 earthquakes in Erzincan are more attractive because they were *designed more modern.* It is commercial buildings that attracted my attention more in Erzincan. The exteriors of *commercial buildings* have a very interesting design and adds a modern touch to Ordu street "(Filiz, personal communication, January 22, 2019).

Figure 13. The trip of Sibel in modern life and her experiences

Sibel investigated and interpreted why there are many murders of crows according to an urban legend in her reflective diary as follows:

> "Although *crows*, which residents of Erzincan see as a major problem, are scary and ugly, they are actually the smartest of the bird species. There are some people who believe in a *myth* circulating in Erzincan. Although it is a folk legend, it impressed me. According to this myth, crows feed on the corpses of the people who remain trapped under debris after the Erzincan earthquake, and they are waiting to feed on more corpses to be caused by the next earthquake, thus reproduce" (Sibel, personal communication, January 13, 2019).

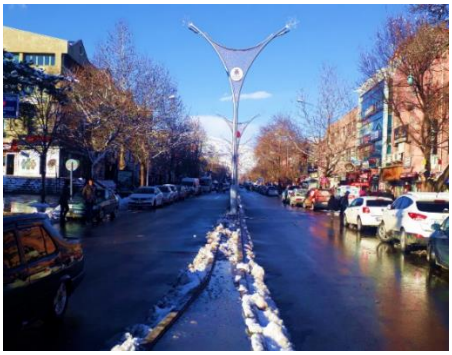


Figure 14. The trip of Salih in modern life and his experiences

In his reflective diary, Salih emphasized that the street leads to visual pollution and aesthetically evaluated it as follows:

> "It is not possible to notice and pay attention to the *architectural details* among the coloured, large and small, illuminated and non-illuminated signs along the street. The architectural structure of the official institutions is much better than the signs on their exterior decorations, which causes a severe visual pollution… On this trip, I had the opportunity to review the places I had previously visited more thoroughly. From a closer perspective, I noticed the beauty of ordinary things. I just noticed the sculpture *'İnönü'* completed by the *sculptor Ratip Aşir Acudoğlu* in 1948 (See Figure 14)" (Salih, personal communication, January 14, 2019).

The fifth trip experience: Pavyonlar Neighbourhood

In this trip experience, the students were asked to observe and examine the cultural and sociological structure of an old neighbourhood in the city. They were asked to compare this one with their previous experiences.

Figure 15. The trip of Salih to Pavyonlar Neighbourhood and his experiences

In his reflective diary, Salih reported that he learned about why this neighbourhood is called "Pavyonlar Neighbourhood" (Pavilion Neighbourhood) with an interview with an old person in the neighbourhood. The student further mentioned about a great socio-cultural difference and questioned the modern life after his trip as follows:

> *"In the Erzincan earthquake*, the buildings of that time were devastated with such a massive destruction. Tent cities were established immediately after the earthquake. The remaining families took the orphans to *tent cities.* The location of Erzincan in Anatolia and harsh winter conditions delayed the work. There were architects of the Greek families living in Trabzon, and *the Greek architects* were commissioned to design a new settlement by the governor of Erzincan in a short time and economic way. The name of this neighbourhood was born here. In Greek architecture, the houses are built adjacent to each other, making the houses stronger and the construction cheaper as the wall of one house is the wall of the other. To get rid of these ruins quickly and to allow for a more economic construction, buildings in PAVILION style were constructed in new Erzincan… The story behind the name of the neighbourhood, which survived till today, is accounted by the old man named Caner as above… I see a big cultural difference between the previous trip to Ordu Street and this old neighbourhood. They were close to one another, but in fact, they were very *different structures from different cultures*. It is notable in Ordu street that the buildings were assimilated from their own cultures, *alienated* from each other and insincere conversations were made for the sake of interest… It was very touching when the people passing by invited us to their home

and offered us coffee. How heart-breaking it is to see the people in these two different places were so different and alienated from their culture. At the end of this trip, I asked myself the last question: Do I prefer a life that is '*MODERN or NOT MODERN?"* (Salih, personal communication, January 24, 2019).

Figure 16. The trip of Mehmet to Pavyonlar Neighbourhood and his experiences

In his reflective diary, Mehmet highlighted the inequality in living standards and drew attention to poor living conditions in the neighbourhood as follows:

"Perhaps it would suffice to look at the *architectural structure* of a city to learn about its character in general… Pavyonlar Neighbourhood is worn out due to the severe earthquakes in the neighbourhood and, so to say, turned into a ruin... The people here bow to the inevitable and live their life quietly. Of course, this affects their living conditions, their choices of food and clothing. They are *malnourished* and dress more modestly… The people here live in *such difficult conditions* that they cannot look to the future with hope; rather they are just *in a hurry to save the day*. In short, they do not have a long-term expectation from life" (Mehmet, personal communication, February 16, 2019).

Figure 17. The trip of Yasemin to Pavyonlar Neighbourhood and her experiences

Yasemin reported that a socio-culturally lower class live in the neighbourhood and emphasized the inequality in education as follows:

"I personally hesitated to go to Pavyonlar Neighbourhood on my own. Because a group of people there exhibits unpleasant behaviours, especially against those from other cities. This poses a problem from *a socio-cultural perspective.* Some families faced with the problem of *earning a living income* are struggling so much that they cannot care for their children and guide them properly on education… Parents need to receive certain education about *the development of their children* to be competent. Among them, there were several *children*, and their sad gaze was very touching. I stopped and talked to them for a while, they were smiling despite all the difficulties and *the brutal life* they endured" (Yasemin, personal communication, February 20, 2019).

Figure 18. The trip of Inci to Pavyonlar Neighbourhood and her experiences

In her reflective diary, Inci questioned Pavyonlar Neighbourhood and the life-style of the people there based on the experiences she had during her trip as follows:

> "Pavyonlar Neighbourhood is subordinate *culturally*. Many houses were nonusable and there were plenty of *glass bottles and waste materials. Old carpets, armchairs, sofas, chairs, and tables* were piled up in front of unused houses. The most important difference in Ordu Street and Pavyonlar Neighbourhood was the cleanliness of the environment" (Inci, personal communication, February 20, 2019).

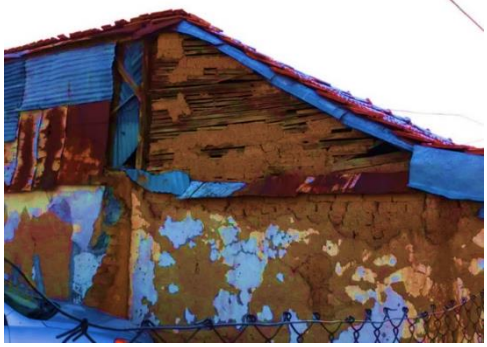

Figure 19. The trip of Cihan to Pavyonlar Neighbourhood and his experiences

Cihan highlighted the injustice experienced by children and expressed his feelings as follows:

> "Generally, those who are not financially well live in this neighbourhood. Old greengrocers, peddlers and ruined houses are very common there… I met a boy living in this neighbourhood by chance and he was *panhandling*… Just because the neighbourhood is a bad neighbourhood, his life is shaped by the conditions there. While we are trying to keep up with *this modern age*, children who do not even have a toy live such a life" (Cihan, personal communication, February 17, 2019).

Figure 20. The trip of Yasemin to Pavyonlar Neighbourhood and her experiences

Yasemin mentioned about different cultures, social inequality and justice based on her experiences from all the trips as follows:

> "*POSHAKS have a different culture*. It is believed that their origin is from Romania. So, this may be the *case* for these people to be called as *Gypsies.* This is a place where many Romanian gypsies live, and they are scattered in many places. Poshaks, particularly women and children, make a living by

> panhandling. Some of them sell textile products door-to-door, which is called peddling. Most men do not work; some of them drive women who are panhandlers or peddlers to where they work. These people that we often see as spending time with the family on a roadside or in a corner of the park are aware that they are *excluded*... It has *mixed* residents. In fact, they reside in the southern part of the city. When I consider Ordu Street and here, I do not feel close to either of these places. The current urban life seems outdated and inadequate. We experience many problems under *urban culture*. I have encountered so many things on this trip… Colourful houses attracted my attention most; although they were very old, they were painted in blue, which I liked very much… We can easily say that they did not change their old lifestyle. I realized in *my interview* that the families with *low income* deal with severe problems to survive; their life standards do not meet today's conditions and they live a forced life… We saw cultural handicrafts in the coppersmiths' bazaar and liked them very much; it is a world-renowned profession as it serves tourists, but it is losing its popularity now. We discussed the economy in our trip to the bazaar, which offered a warmer environment than shopping malls. On the other hand, people tended to consume more as we saw in our trip to the shopping mall. We described the modernity of the houses in Ordu Street surrounded by a green environment and its revival after the earthquake. We learned about *class difference* and the fact that everything *depends on the economy*, and realized how unreliable people may be; we learned so many things in these trips" (Yasemin, personal communication, February 20, 2019).

Under the theme of "Focus Trip Experiences - Exploring", the students had experiences regarding culture in their first trips to the coppersmiths' bazaar, mostly characterized by cultural values, economic values, social values, cultural heritage, intangible cultural heritage (such as traditional crafts, myths, the Alevi culture), tangible cultural heritage (sculptures, architectural building, decorations), multicultural nature, ideological thoughts, women's role in art, arts and crafts. In their second trips to the bazaar, they had opinions and experiences on shopping culture, social cohesion, national consciousness, folk culture (songs, chansonnettes, folk songs), the balance between the strong and the weak and life inequality. In their third trips to the shopping mall, they commented on consumption culture, social class difference, capitalism, sales policies and herd psychology, and visual culture. Further, in their fourth trips, they expressed their opinions on architectural structures, the effect of modernism, the effect of the earthquake, alienation, myths and art spaces and sculptures in the city. In their last trips to Pavyonlar Neighbourhood, they observed socio-cultural differences, income inequality, equal opportunities in education, multicultural nature, the Greek architecture, Poshaks, and Romanian gypsies. In these trips, the students took photos and made interviews, thus had experiences on the social, economic, and cultural aspects of the culture they live in.

Through Life - Realizing

The findings and interpretations on the research questions such as "What did they question regarding this specific culture?" and "What issues did they question and experience regarding this culture?" are presented under this theme. The students had some impressions in their trips and gained social awareness. They were asked seven questions on their trip experiences. Two of these questions aim to understand the nature of the awareness they gained. The first one involved the use of a metaphor: "This trip experience is like a/an… For me. Because…" The second question is: "If you were going to discuss an issue after these trip experiences, what would it be? Why?" After their trip experiences, most of the students addressed the issue of social justice, with emphasis on social and economic inequalities.

Table 1. The metaphors used by the students for their trip experiences

Metaphor	Because…	*Connotation/Theme*
Tunnel	All these trips took me on a constant journey. In a dark journey within myself, I compared the past and present of today's modern men. The past was a cultural journey, a tunnel for time travel.	*Social Inequality, Cultural Differences*
Factory	Thanks to this experience, I eliminated my prejudices. Because the children who grow in bad neighbourhoods are uneducated due to their environment. We need to eliminate prejudices and approach them with love.	*Social Injustice*
Watercolour technique	At first, I did not know what to do… Then I realized how to take photos and what to observe. Just like colours spread on a water surface and blend, the trips became interconnected.	*City and Crow*
Life	I saw new places and met new people on these trips... I gained experience; there were two places with different social classes in the city.	*Social Class Difference*

Hourglass	I was in a constant conflict and adopted a critical approach on all trips. The conflict and comparison of old and new things… the comparison of past and present.	*Old/New Culture-Modernism*
Autumn wind	This travel experience made me long for the past times, which are cold, sad but very familiar to me. A wooden door and a worn door and several poor childhood memories.	*What Modern Life Does Not Let Us Notice*
Entertainment venue	This trip experience taught me to see things that I did not notice. It was nice and fun.	*Pavyonlar Neighbourhood and Culture*
Colour	This travel experience enlivened my life. My trips led me to empathize and to obtain more information and made me think more.	*Cultural Values – Copper Embroidery*
Seed	A small step I took gradually turned to big steps. As my steps grew, I targeted at greater goals and achieved them.	*The Things Destroyed by the Earthquake*
Colours on the palette	We can discover new colours on a palette. This made me learn about new cultures, see the differences between cultures and lifestyles.	*Copper Embroidery and Art*
Light	In a dark environment, we try to see everything illuminated by the light. This was such an experience for me. I learned not only to look, but also to gaze and to see and to question.	*Modern World*
Time travel	I realized that cultural differences and socio-economic differences are great in such a small settlement. I visited both old and new settlements. I travelled to two different worlds on two streets very close to each other.	*Differences in Social Stratification*

As seen in the reflective diaries written by the students and the metaphors used by them, most of the emphasis is put on the issue of "social justice." The students considered the negative events or situations they observed regarding the examples of social injustice, which were witnessed and experienced by the students themselves, as their own problems; they also defined the concept of social justice as an inequality of (economic-educational-cultural) opportunity.

Transformation of Ideas - Creating

The findings and interpretations on the research questions "How did they perceive and interpret the concept of social justice?" and "How did they reflect the issues they questioned and experienced regarding this culture in their art works?" are presented under this theme.

In each of their trip experiences, the students were engaged in a constant questioning. After they gained awareness in Through Life – Realizing stage during the questioning process, the students designed a product on an issue which raised awareness in them. Accordingly, 10 out of 18 artistic products designed by 18 students and the descriptions of the students are presented below.

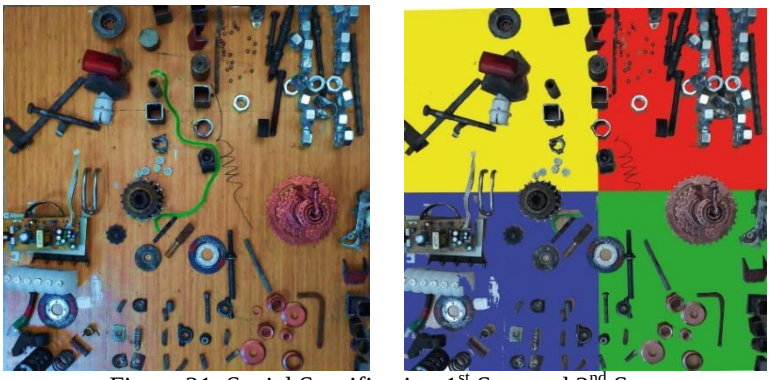

Figure 21. Social Stratification 1st Step and 2nd Step

Salih reinterpreted the work of Mondrian by establishing a link between the visuals based on the locations that he visited and the life experiences he had. He addressed the issue of social class difference in his product as follows:

"In almost all the trips, I focused on the metallization in Erzincan architecture and the robotization of people. From a bird's eye view to Erzincan, I saw that there is a systematic urbanization with no crooked system, which we call grid shape. However, despite this systematic urbanization, the city cannot help but cause visual pollution, and the architecture is an eyesore and is not aesthetically pleasing. This is the point of departure that impressed me most. I tried to reflect Erzincan using the materials matching with the destinations from a bird's eye view as well as the metals that I collected from the places I had been during my trips. In the first step, I thought of dividing the board into four equal parts and painting it to build the city on it. I made sure that these colours contrasted with one another, and I created a sub-floor in the second stage... I downloaded the photos of Erzincan taken from the satellite and put them at the bottom" (Salih, personal communication, April 14, 2019).

Figure 22. Social Stratification 3rd Step and 4th Step

"The third step shows side by side the sketches of the locations of all five trips that I made. In the picture in the fourth step, I placed my materials according to the design of the city. Yet, this created confusion in design. So much so that I could not think of it even when I was in other classes. In the class of Contemporary Art, while the lecturer was talking about non-figurative abstract art, I saw Piet Mondrian's work titled 'Mondrian' and associated it with my assembly that was always on my mind. This work, which is divided into squares, looked like a sketch, and my assembly seemed very complex as its bottom was very dark. In this design, I established a link between my work and that of Mondrian" (Salih, personal communication, April 14, 2019).

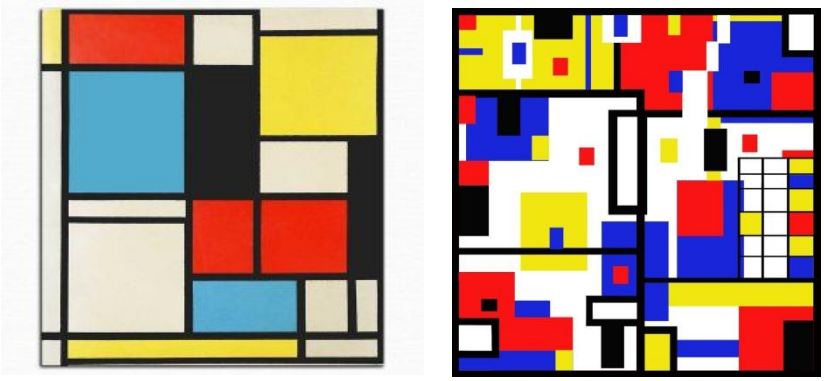

Figure 23. Piet Mondiran "Composition with Red, Blue and Yellow"

"I designed on Photoshop something like the work of Piet Mondrian (See Figure 23). After making this sketch, I placed the urban structure onto it and combined the destinations that I visited" (Salih, personal communication, April 14, 2019).

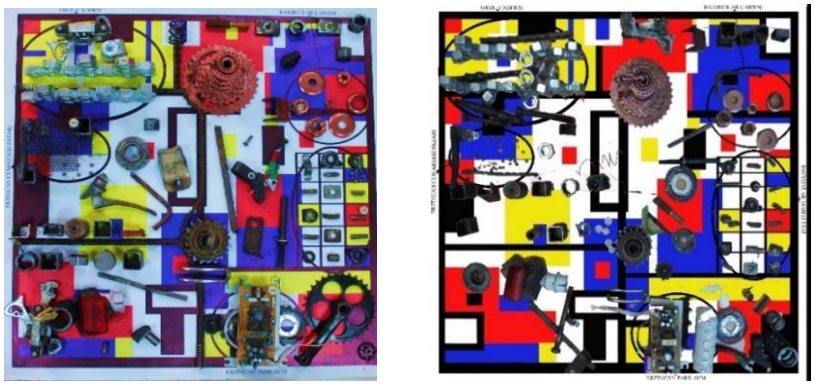

Figure 24. Social Stratification

"I marked the destinations that I visited in my design and connected each area with the metals matching their structure. For example, I used small metal waste to represent the adjacent and small houses of Pavyonlar Neighbourhood (See Figure 24). The copper metals I used symbolize the copper embroidery, and the bright metals symbolize the location of shopping malls. I put the metals in the right colour and shape appropriate to each area" (Salih, personal communication, April 14, 2019).

Figure 25. Copper Bust

Inci referred to the subject of "woman and art" by using the double-headed eagle symbol and the female figure together. She emphasized the importance of copper embroidery with the image of women as follows:

"What I want to discuss with the work that I designed and named as 'Copper Bust' is copper, copper embroidery and hand embroidery. The trip that attracted my attention most and excited me most is the trip to the Coppersmiths' Bazaar. I envisioned my trip plan prior to my assembly work. I focused on 'Copper Embroidery and Hand Embroidery'… I decided to draw the 'Double-headed Eagle' motif belonging to the Seljuk Period. The double-headed eagle means protective dominance. That is, I believe that the double-headed eagle motif emphasizes the value that copper embroidery and hand embroidery deserve in the sense of dominance, and that we need to maintain hand embroidery for the craftsmen who are engaged in copper embroidery and embroidery in general… I preferred the bust to be of a woman for a particular reason. Women are at the forefront of all types of hand embroidery, except for copper embroidery where men remain at the forefront. We should give the same value as we attach to copper embroidery to all types of hand embroidery performed by women, and therefore my bust belongs to a woman… I wanted to highlight the differences between hand embroidery and today's mass production and the value that should be attached to hand embroidery. The purpose of this work is to protect copper embroidery, arts and craftsmen and make them valuable" (Inci, personal communication, April 15, 2019).

Figure 26. Deserted

It is notable that each object in Feride's work was created based on her impressions. She drew on the works of the Dadaist painter Kurt Schwitters while designing her work as follows:

> "Pavyonlar Neighbourhood is the only place that attracts my attention. The financial status of the people, my observations and the culture there affected me. Women were making bread, washing their clothes and carpets and doing other works in the middle of the streets. The major difference between my trip to Pavyonlar Neighbourhood and other trips is the culture as well as the lifestyle of the people… I called my work "DESERTED." Because people visiting that neighbourhood feel like they are in an abandoned place…Pavyonlar Neighbourhood… To create my work, I used waste materials that I collected in the neighborhood and the goods and market products used by them in their daily lives. The following materials were used: A marble stone, cigarette packs, drink bottles, a bulb, ornaments for car, fabric, matchboxes, cables, bags, pine leaves, a lighter tube, and a book page. There were a lot of such materials all over the neighborhood and in the trash cans. Other materials that I used are the wastes used and thrown away by the people there in daily life" (Feride, personal communication, April 7, 2019).

Figure 27. Unbalanced Scale

Ahmet described his work with references to social inequality to such a scale as follows:

> "My assembly work focused on the children whom I remember most from my trip experiences. The fact that the children do not have equal rights while growing up and that the poor have to panhandle or try to find food on the streets as well as the structure of the houses they were brought up and the neighbourhood they live in considerably affect the future of those children. On the other hand, the children, who live in the villas in the neighbourhoods with rich and luxurious houses in Erzincan, receive education in private high schools and own many toys, have a bright future ahead of them. Yet, the poor children do not have a single toy just because they grow in that neighbourhood, which is not their fault. In this inequality, those children panhandle when they are kid and become thieves or lifters when they grow up. Those children, who may succeed in life, are wasted just because of other people around them. In such unequal circumstances, we cannot except those children, who do not have a single toy to play, to be successful. As the first need of those children is love, compassion, and mercy, they will be ready to receive education once they experience these feelings… I describe this inequality using rusted iron and wood. I painted the rich part in gold and the poor part as it is –rusted and like wood- to describe the worn-out lives" (Ahmet, personal communication, April 7, 2019).

Figure 28. The Erzincan Earthquake (Blue Column)

In her work, Filiz described the earthquake and the sufferings and internalized them with an anecdote:

> "First, I felt a jolt, and then, the shock got stronger while I was trying to understand what was happening; the floor slipped under my feet, and this was the day I figured out what an earthquake is. All my family was at home. I was the outside, in the garden of our house with my little sibling, who did not want to get in as if s/he felt that the earthquake would happen that day. S/He was constantly playing games and laughing without knowing what would happen soon. Her/His smiles were replaced by fear. Since then, I can better understand those who had experienced the earthquake… On December 27, 1939, Erzincan witnessed an earthquake. Everyone was tired because of the bustle of everyday life and woke up at 01:57 with a jolt and buzzing while in their sweet sleep. It was not the parents who woke their children up every morning. They opened their eyes with fear and surprise themselves… People came to realize what happened from the floor that shook and slipped under their feet. All desperately uttered 'Earthquake!' in shock... As seen in Figure 28, I attached photos from 1939 and 1992 earthquakes to the upper part. On the right part of the pillar, I glued some newspaper articles about the Erzincan Earthquake and some phrases referring to it. On the left part, there are the photos of today's Erzincan, which I took myself. I also painted the back of the pillar in blue to emphasize that there is still hope. I wanted to show that life continues, and time heals everything, to imply that people should not despair after an earthquake and should always embrace life, to ensure that they take better precautions to avoid such suffering again, and to demonstrate how the ruined lives and a ruined city stood up again" (Filiz, personal communication, April 15, 2019).

Figure 29. Nest

In his work, Mahmut described a family arguing and inequality in life with a crow's nest, which became the symbol of the city, as follows:

> "I designed this work based on a neighbourhood that I visited. Ruined and old houses attracted my attention while I was in Pavyonlar Neighbourhood. I encountered a family arguing in the garden of one of those houses. Unfortunately, people do not have equal lives. So, I called this assembly 'Restless

Home'... I portrayed a restless family arguing. I could only express an uneasy and distressed house in this way… A thorn hurts, makes one uneasy" (Mahmut, personal communication, April 17, 2019).

Figure 30. Frustration

Inspired by the city myth, Sibel used crows in her work. In her diary, she referred to her work as follows:

"Crows… They say crows feed on the corps of those who died in the 1939 and 1992 earthquakes. In this work, the log at the bottom symbolizes the piece of land. Just above it, there is a palette divided into three parts, which tells about the Erzincan earthquake. The colours on the palette represent the ruined lives, hopes and joys. The crows on the palette point to that they feed on the corps of the people who died in the earthquake. Two crows on the branch are looking at the centre of the earthquake; they mean that people were psychologically affected in that earthquake. This work of mine is called Frustration. Why? Because people tell that after the Erzincan earthquake, there is no joy, hope and life, and this work shows that the pain turned into disappointment" (Sibel, personal communication, April 14, 2019).

Figure 31. Face of the Modern Life

Yasemin questioned the modern life and consumption and expressed her opinions as follows:

"I chose the subject of consumption to write about my trips. As I thought that this may be the common subject of all trips…The new aspect of the modern life is consumption. Those who are bored, those eating something, shopping, resting, searching for something different and meeting their needs…The battery mechanism under the chin of the mask and the broken wires mean that our energy is not enough for all this consumption, and our ongoing consumption will only stop when we are faced with a vital situation. The green colour of the mask symbolizes the people poisoned by excess consumption… The plane is white, which represents a starting point and salvation for people. Just as white is produced by the combination of all colours, this turmoil around the mask will come together and lead to a new birth like white. Black lines in the plane, which resemble an inverted ladder, symbolize the rises and falls in this transformation" (Yasemin, personal communication, April 15, 2019).

Figure 32. Modern Hanger

Focusing on modernism and consumption, Vedat explained his work as follows:

> "I chose modernism as the main theme of all the trips I made. While the people of the old times blossomed like a tree sapling, today's modern men look like a barked tree. While we are in search of modernisation, we have been turned into a hanger by this capitalist system… There is a human mask in the middle of the plane as I wanted to emphasize that it is people who consume. The red lips of the mask symbolize women whilst the moustache represents men. The spiral wire around the red lips tells how modern life draws us into its vortex, and the word 'modern' means that everything is marketed under modernity. The spiral wire on the eyes of the mask, which resembles glasses, represents the hypnotized gaze of modern life onto the conception of consumption. The tiny spirals on the forehead of the mask describe the process whereby even our smallest wishes are shaped by this modern consumerism with no limit. The larger spiral wires on the right and left tell us how our brains were turned into a monster in the vortex of consumerism. The straight spirals in the middle symbolize consumption, which is unclaimed, pointless and does not mean anything in any way. The blue colour in the colourful plastic things placed at ear level symbolizes imprisoned freedom, whereas the green colour symbolizes imprisoned naturalness. They are looking downward, which means that we have been overwhelmed with our modern consumerism, taking over everything" (Vedat, personal communication, April 7, 2019).

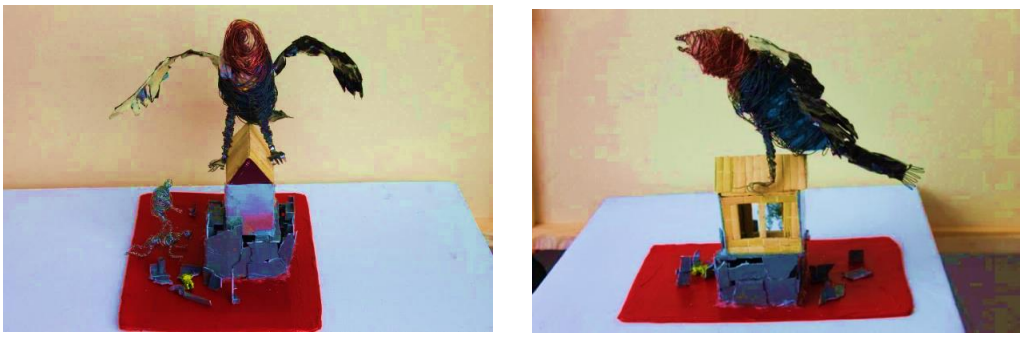

Figure 33. Art and Capitalism

Tarık used crows and humanity in his work on injustice in life, and expressed his opinions as follows:

> "Based on the trips and observations that I made for a period, I believe that people are never equal and cannot come together… I used red for the base of my design as red means sensuality, happiness, and indispensability in art. The meaning of the red colour in my assembly expresses the existence of art, the art itself and the fact that the art will not perish. The house and a few human figures on the art represent capitalism. Today, everyone undermines each other, and people do not even have time to work as they always exploit each other. One has no more strength to contemplate on where the humanity is heading to and what the world and arts turn into. The figures that I used represent those people who reside in the pavilions and crawl to get into their ruined home, and those with low income. Unfortunately, people in higher positions cannot see others sometimes. The tubby figure on top of the other represents the employers. There is a crow on the houses and the piece of art; nobody likes crows. The sounds of crows are disturbing and people find them ugly. Indeed, they are right. Because crows symbolize evil, death and

> darkness. Now, everything, whether it is art or social class, under one thing, that is, under the wings of the crows; both are almost extinct and wait for their time to come to" (Tarık, personal communication, April 14, 2019).

The students demonstrated their perception of the concept of social justice at the end of the a/r/tographic process through their artistic products. They discussed social justice and interpreted it as "inequality in income, family and education opportunities or even gender inequality, cultural class differences, the balance between the strong and the weak, and injustice caused by the capitalist system." As required by the nature of a/r/tographic studies, the students were first engaged in questioning with their trip experiences at the beginning of the research, and then turned their opinions into their products based on the observations they made. The students reported in the interviews that this process was indeed the first of many inquiries into several issues.

Discussion and Conclusion

In this a/r/tographic study, the students visited the places in their city that they had never been before, and experienced the social, economic, and cultural lifestyles of the Eastern Anatolian culture. Some of them made interviews whilst others gained awareness on the social issues they encountered. Under the theme of "Focus Trip Experiences-Exploring", the students had experiences regarding culture in their first trips to the coppersmiths' bazaar, a place mostly characterized by its cultural, economic, social values and its role in cultural heritage, intangible cultural heritage (such as traditional crafts, myths, the Alevi culture), tangible cultural heritage (sculptures, architectural building, decorations), multicultural nature, ideological thoughts, women's role in art, arts and crafts. In their second trips to the bazaar, they had opinions and experiences on shopping culture, social cohesion, national consciousness, folk culture (songs, chansonnettes, folk songs), the balance between the strong and the weak, and inequality in life. In their third trips to the shopping mall, they commented on consumption culture, social class difference, capitalism, sales policies and herd psychology, and visual culture. Further, in their fourth trips, they expressed their opinions on architectural structures, the effect of modernism, the effect of the earthquake, alienation, myths and art spaces and sculptures in the city. In their last trip to the Pavyonlar Neighbourhood, they observed socio-cultural differences, income inequality, unequal opportunities in education, multicultural nature, the Greek architecture, Poshaks, and Romanian gypsies. In these trips, the students took photos and made interviews, thus had experiences on the social, economic, and cultural aspects of the culture they live in. They questioned the concepts of justice, social inequality, educational inequality based on the things they encountered in Pavyonlar Neighbourhood and the impressions they had about the children there. They visited these places in the city they are studying and learned about the culture, nature, lifestyles, and shopping culture of the city through real-life experiences. They personally observed and questioned the class difference and the gap between the rich and the poor created by the capitalist system. After these trips, the students emphasized that cultural values disappeared, and that everyone is the same, and understood the importance of preserving cultural values and traditional handicrafts. The findings above are congruent with the findings of the study of Kazmarski (2017). Kazmarski asked secondary school students to carry out art practices and analysis on social issues through a practice based on social justice during the arts education course. In this study, the students reported that they learned through experiences and by asking questions, which is different from their previous learning experiences. They further stated that each trip offered a different perspective for them and they gained awareness towards social life. They also examined the places, which they frequently visit, with a critical eye. These findings support the arguments of Garber (2004) and Ploof and Hochtritt (2018) on social justice in art education. Applying the social justice theory to pre-service teachers, Garber helped them understand their cultural values, experiences, the world, and their identities in consumer society. In addition, they cooperatively produced the dominant and widespread culture away from their own cultural values through art. In Garber's study, the pre-service teachers realized how painful racism, sexism and other forms of discrimination are. They also discovered racism and the movements against it. Ploof and Hochtritt (2018) put forth that social justice practices in art education encourage critical thinking, reveal the balance/imbalance of power in society and make people think about personal and social realities.

The reflective diaries written by the students and the metaphors used in them under the theme of "Through Life-Realizing" mostly focus on "social justice" as the main issue. The students considered the negative events or situations they observed regarding the examples of social injustice, which were witnessed and experienced by the students themselves, as their own problems. They also defined the concept of social justice as inequality of (economic-educational-cultural) opportunity. Stevens (2015) performed a study on art-based social justice and included her own experiences as a student. This study discussed social justice under two titles: Inequalities faced by students in education and inequalities in social life. These findings are congruent with the study of Hochtritt, Ahlschwede, Dutton, Fiesel, Chevalier, Miller and Farrar (2017). Their study observed that

encouraging students to ask questions in a course that focuses on issues related to social justice would reveal their understanding of public, education, power and privilege, increase the importance of such alternative learning areas, and offer various answers and inquiries.

The students in this study reported that the trip experiences under the theme of "Transformation of Ideas – Creating" enriched the artistic creativity of themselves and allowed them to present ideas with different ways of thinking. This supports of the arguments of Desai (2010) on the relationship between art education and social justice education. Desai (2010) expressed that social justice programs and art practices transform learning processes in art education programs, and claimed that these programs allow for thinking and rethinking, and that such free practices in education improve the thinking style of students and encourage creativity. The students in this present study reported that their perspectives were changed and enhanced thanks to the trip experiences within a short period of time, and that they visited different places and assessed their cultural and social aspects. They also stated that with the knowledge and perspective they obtained from these trip experiences, they discovered how to add a meaning to their lives and the images they would paint. Based on these experiences, the students, who argued that people do not have equal rights in any way, questioned their lives in terms of social justice. They exhibited these forms of inquiries through the artistic works they created after their trip experiences. In these works, the students first wrote on, then experienced the issues of social stratification, injustice, capitalism, the effect of geography on culture, class diversity, multiculturalism, human becoming a consumption object, culture shaping art, craftsmanship and artistry, and eventually turned these issues into a product. While designing these products, the students assigned a meaning to everything they encountered during their trip experiences, including their observations, the photos they took, the people they talked to, their research, and accordingly created their designs. They created these products by questioning their experiences. A similar piece of finding was obtained by Sosin, Bekkala and Pepper-Sanello (2010). They carried out art practices in high school visual arts curriculum as a branch of social justice education. The students produced images to provide insights into social awareness and their perceptions of working in today's global environment through their powerful, realistic, and fantastical images. Thus, they learned about the issues they put into question, and reflected them through different modes of artistic expression.

In sum, the students in this study acted as learners in a real-life research process by questioning the concepts of justice, equality and life in their trip experiences, set out as artists by creating designs based on the concepts they questioned in their artistic works, and turned into researchers by investigating the things they encountered and the opinions they obtained in the research process.

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International Journal of Contemporary Educational Research (IJCER)

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Problem Posing with Third-grade Children: Examining the Complexity of Problems

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To cite this article:

Kar, T., Öçal, T., Öçal, M. F. & Demirci, Ö. (2021). Problem posing with third-grade children: Examining the complexity of problems. *International Journal of Contemporary Educational Research, 8*(1), 54-71. DOI: https://doi.org/10.33200/ijcer.820714

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International Journal of Contemporary Educational Research
Volume 8, Number 1, March 2021, 54-71 ISSN: 2148-3868

Problem Posing with Third-grade Children: Examining the Complexity of Problems

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Abstract

The purpose of this study was to investigate what factors third-grade students took into consideration when posing problems for their peers and how these factors affected the mathematical complexities of the problems. Free and semi-structured problem-posing tasks were given to 27 third-grade students, and the problems they created for their peers were analyzed in terms of their semantic structure and arithmetic complexity. According to the findings of the study, there was a statistically significant difference between the semantic structures of the problems in both tasks created for the more mathematically proficient student, but there was no difference between their arithmetic complexities. In addition, according to the qualitative findings of the study, the magnitude of the numbers, the operation types, the number of operations used, and the interests of the students were taken into consideration in posing problems for students with low and high levels of mathematical ability.

Keywords: Arithmetic complexity, Arithmetic operations, Problem-posing, Semantic structure, Word problem

Introduction

Problem posing, also referred as problem finding, problem formulating, and problem creating (Singer & Voica, 2013), has recently taken interest of mathematics education researchers. Problem posing is an open-ended cognitive activity and is considered to be an important component of inquiry-based learning (Silver, 1997); therefore, it solidifies its importance within mathematics education. Whether problem posing is considered as a means of instruction (to engage students in learning important concepts and skills and to enhance their problem-solving competence) or as an object of instruction (to develop students' proficiency in posing mathematics problems), it should be included in the classroom assessment activities in both situations (Silver & Cai, 2005). This is because the problems that students pose reveal significant information about their mathematical understanding (Xie & Masingila, 2017).

In some problem-posing studies (e.g., Bonotto & Santo, 2015; Cai, 2003; Ellerton, 1986) participants are expected to pose complex/difficult problems. These kinds of directives have important potential for students' learning (Chen, Van Dooren, Chen & Verschaffel, 2007). Problem posing improves students' problem solving and creative thinking skills (Silver, 1997) because participants are questioning deeply mathematical structure of the tasks (Kar, Özdemir, Öçal, Güler & İpek 2019; Xie & Masingila, 2017) and think about the solution of the problem (Cai, 2003) during this process. In this context, expecting the students to pose complex problems contributes to their active use of the thinking, reasoning, and justification skills emphasized in the documents of National Council of Teachers of Mathematics (NCTM, 2000), and giving them opportunities to think in-depth about the mathematical structures in the proposed tasks. At the same time, these skills are among the components of mathematical proficiency. As such, it is recommended to conduct an in-depth investigation of a problem situation to improve them (Kilpatrick, Swafford & Findell, 2001).

One of the questions that Cai, Hwang, Jiang and Silber (2015) asked for investigating problem posing was as follows: "How do different characteristics of problem situations affect subjects' problem posing?" (p. 9). The conducted studies indicated that problem-posing performance (i.e., mathematical validity and solvability) differs according to the special conditions of the problem-posing tasks (e.g., being in free, semi-structured, and

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structured forms), even though they aimed at measuring the same skill (Christou, Mousoulides, Pittalis, Pitta-Pantazi & Sriraman, 2005; Çetinkaya & Soybaş, 2018; Kılıç, 2013; Silber & Cai, 2017; Stickles, 2011). Therefore, the task format should be taken into consideration while making evaluation about students' problem-posing performances or other skills such as problem solving related to the problem posing. In addition, it is an important question to be answered whether there are other factors affecting the quality of the problems posed by students. In this context, previous studies have included directives such as "pose a problem for your friend" (e.g., Cankoy, 2014; Kopparla et al., 2019; Lowrie, 1999). Do such directives effectively allow addressing the students' complex problem-posing performances? More specifically, when third-grade students are asked to "pose a problem for your friend," does the particular friend's mathematical ability affect the complexity of the problem posed? This study aimed to investigate what factors third-grade students took into consideration when posing problems based on such directives and how these factors affected the mathematical complexities of the problems.

Theoretical Framework

Problem Posing and the Classification of Problem-Posing Tasks

Problem posing is defined as the generation of new problems or the reformulation of existing problems (Silver, 1994). In the literature (Christou, et al., 2005; Silver, 1994; Stoyanova & Ellerton, 1996), various criteria were taken into consideration for developing different problem-posing frameworks. Stoyanova and Ellerton (1996) described the widely accepted classifications within these frameworks as free, semi-structured, and structured situations in which students are asked to pose problems that are appropriate for the given situation. These questions can be posed without any limitations in free situations (e.g., "pose a difficult problem for your friends"). In semi-structured situations, students are given open-ended scenarios (e.g., "pose a problem using data from a graph"). In structured situations, well-structured tasks are presented (e.g., "pose a problem appropriate for the following equation: $(25 + 12) – 17 = ?$").

Bonotto and Santo (2015) stated that free and semi-structured problem-posing tasks encourage creative thinking and thus stimulate students' problem posing. In addition, Lowrie (1999) emphasized that free problem-posing tasks increase students' motivation, while Stoyanova and Ellerton (1996) indicated that students are more likely to reflect their own experiences through these tasks. Thus, in line with these views, our activities were designed with the assumption that they would allow students to reflect their own knowledge and creativity while posing problems. In the light of these explanations, more data will be available related to these types of activities and how students think about them when posing problems for their friends.

Mathematical Complexity of Word Problems

Responses to problem-posing tasks are evaluated in different ways depending on the purpose and the scope of the study. One of the most common approaches used in the evaluation of problems is mathematical complexity (e.g., Marshall, 1995; Silver & Cai, 1996, 2005). Mathematical complexity refers to the kinds of cognitive demands required to solve a problem; the problems whose solutions are more difficult are considered to be more complex (Lee & Heyworth, 2000). As such, complexity is one of the crucial features of posed problems and it reflects students' mathematical understanding and cognitive processes (Kwek, 2015). In the problem-posing process, the concepts in the task are analyzed in-depth and are linked to different mathematical concepts. Furthermore, the validity of the problem is questioned mathematically (Kar et al., 2019; Xie & Masingila, 2017). In this context, the attempts to pose complex problems can make students more active in terms of mathematical thinking and reasoning and, at the same time, they develop their problem-solving skills. Additionally, the attempts to pose more complex problems foster students' creative thinking skills (Silver, 1997) and give students opportunities to make connections between mathematics and their interests, which is often not the case in solving routine problems (Cai et al., 2020). Therefore, expecting students to pose complex problems makes an important contribution to their mathematics learning.

The complexities of the problems that students pose can be determined using many different perspectives. One way to determine the complexity of a word problem is changing the type and the number of operations included in it. This kind of approach is defined in the literature as arithmetic complexity (Leung & Silver, 1997; Silver & Cai, 1996). Although the number of steps gives an idea of the arithmetic complexity of the problem, it has a significant limitation. Leung and Silver (1997) reported that multi-step problems are more difficult than single-step problems, but a problem with five steps does not necessarily have to be more difficult than a problem with four. This is because, due to the absence of solutions, we cannot determine which problem (the one with four steps or the one with five steps) is more difficult than the other. Therefore, the single-step and multi-step

distinction is taken into consideration in the analysis of arithmetic complexity. For example, Bonotto and Santo (2015) examined the problems posed in a situation requiring the use of real-life artefacts. They analyzed valid problems posed by fifth-grade students according to their arithmetic complexity. The researchers found that more than three-fourth of the problems posed by the students were multi-step problems. In another study, Chen et al. (2007) asked Chinese fourth- grade students to pose easy, moderately difficult, and difficult problems related to an open-ended story and they analyzed the arithmetical complexity of their responses according to whether they were single or multi-step. Students posed more complex problems in cases where they were expected to pose difficult problems. The results of this study suggested that the application of the activity had an influence on the mathematical complexity of the problems.

Another common approach taken for determining the complexity of word problems is semantic structures which refers to the relations among the quantitative data in the problem's text. These structures influence problem-solving performance (Bernardo, 1999; Marshall, 1995; Mulligan & Mitchelmore, 1997; Yeap & Kaur, 2001). Due to the way of mathematical relationships presented in the problems may make it difficult for students to form mental representations for the mathematical structure of the problem, it may increase the possibility of making mistakes in selecting solution strategies (Bernardo, 1999). Marshall (1995) divided word problems into five semantic structures—change, group, compare, restate, and vary—according to the relationship among the numeric quantities rather than their context or synthetic features. This classification of word problems is situation-based rather than operation-based (Yeap & Kaur, 2001). According to this classification, problems involving more semantic structures are thought to be more complex than those involving fewer structures (Marshall, 1995; Silber & Cai, 2017; Silver & Cai, 1996). The sample problems reflecting Marshall's (1995) five sematic structures were presented in Table 1.

Table 1. Examples for semantic structures in Marshall's (1995, p. 72) classification

Types	Sample problem
Change	Stan had 35 stamps in his stamp collection. His uncle sent him 8 more as a birthday present. How many stamps are there in his collection now?
Group	In Mr. Harrison's third-grade class, there were 18 boys and 17 girls. How many children are there in Mr. Harrison's class?
Compare	Bill walks a mile in 15 minutes. His brother Tom walks the same distance in 18 minutes. Which one is the faster walker?
Restate	At the pet store there are twice as many kittens as puppies in the store window. There are 8 kittens in the window. How many puppies are there also in the window?
Vary	Mary bought a package of gum that had 5 sticks of gum in it. How many sticks would she have if she bought 3 packages of gum?

Change refers to a difference in the quantity of a single item over a period of time. Marshall (1995) stated that there are three important numbers in this situation: the amount prior to the change, the extent of the change, and the resulting amount after the change has occurred. In the first problem shown in Table 1, Stan's 35 stamps at the beginning represent the amount prior to the change and the 8 additional stamps sent to him as a birthday gift represent the extent of the change. Accordingly, the total number of stamps in the collection represents the resulting amount after the change. In a *group* situation, there is a meaningful combination of small groups within a larger group. Marshall (1995) stated that there must be three or more numbers in this situation: the size of each subgroup and the size of the group as a result of their combination. In the second problem shown in Table 1, the 18 boys and 17 girls in the classroom represent the small groups, while total classroom size represents the bringing together of these groups to form a larger group. A *compare* situation exists whenever two things are contrasted to determine which of them is larger or smaller (Marshall, 1995). The third problem in Table 1 is about determining the faster person by comparing how long Bill and his brother take to walk a length of one-mile. *Restate* refers to the relationship between two items at a specific point in time. This relationship occurs at a certain time of the story, but a wider context cannot be generalized. Marshall (1995) emphasized that these relations should be expressed with numerical values as well as statements like existence of twice as great as, three more than, or one half of. In the fourth problem in Table 1, the expression "there are twice as many kittens as puppies in the store window" represents this condition. In a *vary* situation, the relationship between two things does not dependent on a specific time. In this structural relationship, although the numbers of the variables decrease or increase, the relationship is preserved. The situation derives its name from the fact that if one varies the amount of one thing, the amount of the second changes systematically as a function of the known relationship (Marshall, 1995). The last problem in Table 1 represents the functional relationship between one package of gum and the sticks of gum it holds with the expression: "a package of gum that had 5 sticks of gum in it." In this problem, there are fixed five sticks of gum for each package. The number of the sticks of the gums

increase depending on the increase in the number of the packages. Therefore, the relationship between the numbers of the packages and sticks of the gums will be preserved.

Silver and Cai (1996) asked primary school students to pose three problems for an open-ended story and analyzed the problems according to Marshall's (1995) classification of semantic structures. It was determined that more than 60% of the posed problems contained at least two semantic structures, and the problems posed as a second response were more complex than the first ones. Yeap and Kaur (2000) investigated the relationship between third- and fifth-grade students' problem-solving and -posing performances according to grade levels and activity types. The posed problems were also analyzed using Marshall's (1995) classification. The findings of this study indicated that fifth-grade students posed more complex problems than third-grade students did, and that the problem-posing activity types affected the problems' semantic structures. Papadopoulos and Patsiala (2019) asked fourth grade students to pose problems for open-ended tasks (e.g., "Peter has 75 cents…", p. 4) without any external intervention in the first phase and benefitting from the what-if technique in the second phase; they noted the issues to which teachers called attention in the last phase. The mathematical complexities of the problems were analyzed according to Marshall's (1995) schema. It was determined that less than half of the posed problems in the first and second phases involved two or three semantic relations, while this rate increased to more than 60% in the last phase. This study reveals that systematic teaching on problem posing contributes to the development of the mathematical complexity of problems.

In this study, Marshall's (1995) situation-based classification was used. One of the strengths of this classification is that it enables the analysis of problems posed in free and semi-structured activities as were used in this study. Another strength is the opportunity to make statistical comparisons (e.g., Silver & Cai, 1996; Yeap & Kaur, 2001). This is because this classification focuses on the nature of the relations among the mathematical quantities rather than on the operation types. For example, a change in the semantic structure refers to a difference in the quantity of a single item over a period of time in this schema (Marshall, 1995). If an operation-oriented classification is taken into consideration, this would be classified as a separate semantic structure if there was a decrease over time and as a join semantic structure if there was an increase. Although the arithmetical operations are different, the relations between mathematical quantities have a similar structure. Therefore, Marshall (1995) classified both of these two situations under the category of a change in semantic structure.

The Factors Affecting Posing Complex Problems

One of the factors affecting the complexity of problem-posing performance is the task format (e.g., Geçici & Aydın, 2020; Leung & Silver, 1997; Silber & Cai, 2017; Silver & Cai, 1996). Participants posed mathematically more complex problems in structured problem-posing activities compared to those in free activities (e.g., Silber & Cai, 2017) and in the tasks containing specific numbers compared with those without specific numbers (e.g., Leung & Silver, 1997). Another factor that affects the complexity of problem-posing performance is the manner in which the activities are applied. For example, Chen et al. (2007) determined that when fourth-grade Chinese students were asked to pose easy, moderately difficult, and difficult problems for an open-ended story, the arithmetic complexity of the problems was greater in the case of posing difficult problem. Chapman (2012) indicated that the extent to which problem-posing is perceived as sense-making influences the complexity of the problems posed. For example, from the paradigmatic perspective, problem-posing is the creation of a problem with a universal interpretation, a particular solution, and an existence independent of the problem solver (Chapman, 2012). This perspective results in posing simple problems.

Students were asked to pose a problem for a particular person (e.g., for a friend, for a student with high mathematics ability) in a limited number of studies. In these studies, students were directed, for example, to "pose a (difficult) problem for your friend". This type of directive is seen as an important way both to motivate students and to understand their mathematical abilities (Cankoy, 2014; Lowrie, 1999, 2002). Winograd (1997), working with primary school students, indicated that students were highly motivated to pose interesting and difficult problems for their classmates, and they did not lose interest in the process of sharing their problems in the classroom environment. Ellerton (1986) stated that asking students to "pose a difficult problem for your friends" may affect students' success in performing the problem-posing task because the students' focus may be shifted to external factors. When using these directives, students do not always pose problems for their close friends, but they also pose problems for those who like to solve difficult problems (Lowrie, 1999). These results indicate that, during the problem-posing process, problem posers also focus on how the person who will solve will perceive the components of the problem.

Although there are studies that direct students to pose problems for their friends (e.g., Cankoy, 2014; Kopparla et al., 2019; Lowrie & Whitland, 2000; Yeap & Kaur, 2000), there has thus far not been a study examining the

situation that is explored here. For example, two activities in Yeap and Kaur's (2000) study directing third- and fifth-grade students to pose problems were as follows: "…Your problem must have the numbers 3, 5 and 36. You can use more numbers, if you like" and "…The answer to the question in the problem must be 10." In both activities, students were given the following instruction: "Write a mathematics word problem for a friend to solve" (p. 606). The complexity of the problems posed for these activities were determined by means of Marshall's (1995) classification of semantic structures. The students posed more complex problems by using the numbers 3, 5, and 36 in the problem-posing activity. Although the reasons behind the success difference were not explored in the study, the presentation of the activity might be a factor. Additionally, students could pose problems in each activity by considering the different mathematical abilities of their friends, which might also result in differences in the complexities of the problems.

Lowrie and Whitland (2000) asked third-grade students to pose problems for second and fourth graders. They found that the third-grade students considered number magnitude, operation complexity, the type of mathematics concepts, and students' interests while posing problems. Students decreased the magnitude of the numbers for second graders and tended to use numbers with higher magnitudes for fourth graders in their problems. The researchers also found that some students posed problems using the content of the third-grade mathematics curriculum with the aim of helping the second graders improve their ability. The results of this study indicate that there might be differences between the problems posed for different grade levels in terms of arithmetical complexity. On the other hand, this result was not determined via quantitative approaches and, additionally, this study did not focus on the semantic structures of the problems. Thus, this study does not provide data on the factors that students consider in posing problems for their classmates. Cankoy (2014) conducted a five-week study investigating the effect of interlocked and traditional problem-posing instructions on fifth-grade students' problem-posing performance. A free problem-posing activity was used in the study and students were expected to pose problems for their friends. The posed problems were analyzed according to the dimensions of solvability (whether they were solvable or unsolvable), reasonability (whether they were reasonable or unreasonable), and mathematical structure (whether they were result unknown or start unknown). The results indicated that interlocked problem-posing instruction improved students' problem-posing performance more than traditional instruction.

When examining the aforementioned studies, some (Cankoy, 2014; Kopparla et al., 2019) did not focus on the mathematical complexities of the posed problems. In the studies focusing on the complexities of the problems, on the other hand, the performances of student groups were compared according to activity types (Yeap & Kaur, 2000), or students were asked to pose problems for different students in different grade levels (Lowrie & Whitland, 2000). Such studies do not provide explanations about the factors that students consider when posing problems for their classmates. Moreover, Lowrie (1999) pointed out that students could pose problems not only for their close friends but also for their friends who like to solve difficult problems. This explanation implies that students can adjust the complexity of the problems by considering the friend for whom the problem is posed. However, the literature reviewed reveals that whether students adjusted the complexities of the problems for their friend was not tested by means of quantitative approaches. As Silver (2009) indicated, complex problems sharpen students' mathematical thinking and reasoning skills. In this regard, quantitative approaches can provide strong results about students' tendencies in posing more complex problems for their friends having higher mathematics success. Therefore, this approach can provide experimental data based suggestions for their use in learning environments. In addition, students were asked to pose problems for their friends in the experimental studies on problem posing (e.g., Cankoy, 2014; Kopparla et al., 2019). In the pre-test and post-test stages of such experimental studies, the fact that the student wrote problems by taking into account his/her different friends may have affected the complexity of the posed problems. Therefore, the results of the present study may deepen our understanding of an important variable to be considered in creating experimental designs and interpreting students' problem-posing performance.

Although students are capable of posing problems, we have very limited in-depth understanding about how they think and what type of situations they take into consideration while posing problems (Cai, et al., 2015; Cai & Leikin, 2020). For example, the results of Lee's (2020) study showed that only a small portion were related to problem posing (62/17456 about 0.4%) among the research published in 13 academic journals particularly related to mathematics education, and only four studies were interested in the students' thinking processes. Supporting this study with qualitative approaches as well as quantitative approaches will give insight into what factors students take into account when writing problems for their friends, the role of the complexity of the problem as one of these factors, and what kind of arrangements they make to adjust the complexity of the problem. Therefore, the results of this study will deepen our understanding about how students think when they pose problems for their friends. This study is aiming to fill this gap in the literature.

Research Questions and Hypotheses

The present study attempted to answer the following research questions:

1. Is there any statistical difference among the arithmetical and semantic complexities of the problems that third-grade students pose for their classmates?
2. How do third-grade students think when posing problems for their classmates?

When students pose problems, besides focusing on the mathematical structures of the activity (e.g., number magnitude, number and types of operations) (Lowrie & Whitland, 2000), they also consider many other factors including the interests of the person or the group to be posed for (Chapman, 2012; Lowrie & Whitland, 2000) and the association of the problem with daily life (Rosli et al., 2015; Winograd, 1997). According to the hypothesis of this study, therefore, it is assumed that there will be no difference in the semantic complexity of the problems that students pose for different classmates. A similar assumption is made about the arithmetical complexity of the problems.

Method

Sample

This study was carried out with a primary school teacher working in a public school in Turkey and 27 third-graders. The students were 9–10 years old. The teacher had 13 years of teaching experience while the study was implemented and was studying for his master's degree at the time. All the students were educated in their native language, and their school was one of the popular schools in the city center. The socio-economic and educational levels of the students' parents were relatively similar and were medium or high in general.

The Problem-Posing Experience of the Teacher and Student Selection

One of the authors of this study and the teacher had been discussing the teaching of primary school mathematics in regular meetings for more than a year. In these meetings, they discussed methods for teaching primary school mathematics, problem-solving and problem-posing skills, and the meaning of mathematical understanding.In some meetings, they discussed the definition and the importance of problem posing, the classification of problem-posing tasks, and the types of analytical schemas used. In addition, some problem-posing tasks were carried out by the teacher in his classes, and his observations were discussed in the meetings. Thus, it was ensured that the teacher conducting this study had experience in problem-posing activities. In these meetings, some studies (e.g., Cai & Ding, 2017; Kilpatrick et al., 2001) related to the nature of mathematical understanding and its components were discussed. For example, Kilpatrick et al. (2001) identified five components of mathematical proficiency: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. Thus, the primary school teacher conducting this study had knowledge about mathematical understanding.

Undoubtedly, students' abilities are best recognized by the teacher who is with them daily. Furthermore, there are no written exams at the third-grade level. Therefore, the primary school teacher was expected to divide the students into four groups according to their mathematical understanding. Then, he was expected to choose two students from the four groups: the one from the group with the highest mathematical understanding and the one from the group with the lowest mathematical understanding. He considered criteria such as conceptual understanding, procedural fluency, and strategic competence in selecting the students. The teacher chose Kerem from the group with the highest mathematical understanding and Ecrin from the group with lowest mathematical understanding (pseudonyms have been used). The teacher explained the mathematical understanding of Ecrin and Kerem as follows:

> For Kerem: The most important characteristics of Kerem are being capable of mental processing and solving problems in different ways. He makes the operations faster and establishes the connections between the mathematical expressions in the problems and the necessary operations better, compared to his peers. He is also the head of the math club of our class.
>
> For Ecrin: She is a third-grade student, but lacks some mathematics knowledge related to first- and second-grade mathematics content. She is far behind in rhythmic counting compared to her friends, she forgets the mathematics subjects she has learned in previous years, she is very weak in mental processes, and she often makes mistakes in arithmetic operations. She especially has difficulty in solving two-step problems.

Student Background

A free problem-posing (FPP) task was implemented in the fall period. At the time of the implementation, the teacher stated that he taught addition and subtraction with three-digit numbers and included problem-solving activities that required the use of these operations. Furthermore, he stated that the problems were limited to what students learned in second grade in terms of multiplication and division, such as multiplying numbers up to 10 by one, two, three, four, and five, and dividing numbers up to 20 without remainders. The teacher emphasized that more complex multiplication and division operations are mainly included in the third- and fourth-grade curricula, and noted that he had not yet started teaching multiplication and division with two-digit and larger numbers at the time of the FPP task. A semi-structured problem-posing (SSPP) task was implemented approximately one month after the FPP task. During the implementation of the task, the teacher had just started teaching multiplication. At this stage, he stated that he conducted activities by reminding students of the multiplication subjects found mainly in the second-grade curriculum.

Problem-Posing Activities and Administration Procedure

In this study, FPP and SSPP tasks (see Figure 1) were given to students. The students were asked to pose a problem for their two friends, determined by their teacher, and each of the problem-posing tasks was completed in about 20 minutes. The teacher gave the students the impression that Ecrin and Kerem were randomly selected and their mathematics success was not mentioned to the class during the process. The teacher stated that students could find it difficult to follow the written directions so the teacher suggest that it would be more appropriate to explain what students have to do verbally before the implementation. In line with these opinions, no instructions were included in the tasks; instead, the teacher gave explanations to the students during the implementation process. The explanation given during the FPP task was as follows:

> In this lesson, you will pose problems for each other. I will randomly select two of your friends, and you'll pose a problem for each of them. Then, we will continue to practice our activity for different friends. I want you to pose one problem each for Kerem and Ecrin. You can start with whomever you want.

In the SSPP task, students were given an open-ended task associated with daily life (see Figure 1). This problem-posing task was derived from the study by Silver and Cai (2005), who stated that this activity can be used for classroom assessment of activities involving the addition and subtraction of two-digit numbers. Considering the purpose of this study, there were many reasons for choosing this task. First, because the teacher was still in the early stages of teaching multiplication and division, he stated that it would be more appropriate to use a data set unrelated to multiplication. Second, expanding the amount of data in the open-ended task would limit the problems to be posed. This would create obstacles to flexible thinking in differentiating problems. During the implementation phase, the students were given the following instruction:

> I'll give you an incomplete problem sentence. Imagine that you wrote the problem up to this point. You will write math problems for your friends by completing them as you wish. I want you to write one math problem each for Ecrin and Kerem. You can start with whomever you want.

FPP Task	SSPP Task
Write one math problem for Ecrin and Kerem.	By beginning with the information given below, write one math problem for Ecrin and Kerem. *Ayşe has 34 marbles, Burak has 27 marbles and Zeynep has 23 marbles.*
My friend's name for whom I posed the problem:	My friend's name for whom I posed the problem:
My friend's name for whom I posed the problem:	My friend's name for whom I posed the problem:

Figure 1. Problem-posing tasks and instructions given to the students.

The FPP and SSPP activities were not limited to posing problems only for Ecrin and Kerem. If that were the case, the other students in the classroom might conjecture that Ecrin and Kerem were not randomly selected. As a result of the discussions among the authors and the classroom teacher, it was decided that it would be more appropriate to have other students be involved in the activities, too. Therefore, before posing problems for Ecrin

and Kerem in the FPP activity, similar processes were carried out for different students. In the SSPP activity, students were asked to pose problems for Ecrin and Kerem first and then to pose problems for some other randomly selected students. Thus, this process aimed to prevent students' from conjecturing that Ecrin and Kerem were deliberately selected.

Semi-Structured Interview Process

Semi-structured interviews with six students were carried out after each activity to better understand how students were thinking when they were posing problems. The teacher's opinions were taken into account in the selection of the students. The teacher was expected to identify six students reflecting the mathematical success of the classroom using the same selection criteria used for selecting Ecrin and Kerem. In the selection of Ecrin and Kerem, the teacher had divided the students into groups. Using a similar approach, the teacher was asked to think of the students as three groups with low, medium, and high levels of mathematical understanding and choose two students from each group. It was emphasized that the selected students should be open to communication to allow an in-depth investigation and enable the researcher to gather rich data in the interviews. Using this approach, the teacher chose six students.

The classroom teacher routinely organizes short meetings with some students at the end of the day to talk about their activities during the day. It was decided that the semi-structured interviews would be conducted at these meetings to hopefully prevent the other students from developing possible prejudices against the students interviewed. The interview process was shaped around the students' explanations of how each problem was posed. In the interviews, students were not asked any questions indicating or implying Ecrin or Kerem's mathematics success. It was thought that the students might emphasize Ecrin and Kerem's mathematics successes when explaining how they posed their problems. In such cases, it was decided that students would be asked only to explain their thoughts in more depth. It was also predicted that some students would pose problems for the other student based on the problem posed for either Ecrin or Kerem. This is because in the literature, it is emphasized that students give chained responses to problem-posing activities (e.g., Silver & Cai, 1996). It was also taken into consideration that third-grade students could write systematically complicated problems for their friends and provide explanations about the differences between these problems in interviews. In these cases, it was decided to ask the student for a more detailed explanation to understand the differences between the posed problems. We decided to use the following questions in this regard: Are these two problems different? If so, what are the differences? What are the factors that are effective in posing different problems?

Data Analysis

Since it would not be appropriate for Ecrin and Kerem to pose problems for themselves, their responses were not included in the analysis. Thus, the responses of 25 students were analyzed for both tasks. The problems that the students had posed were analyzed first for mathematical viability. Problems that could not be solved or that contained errors were evaluated as non-viable problems. The viable problems were then analyzed according to their semantic structures and arithmetic complexities (see Figure 2).

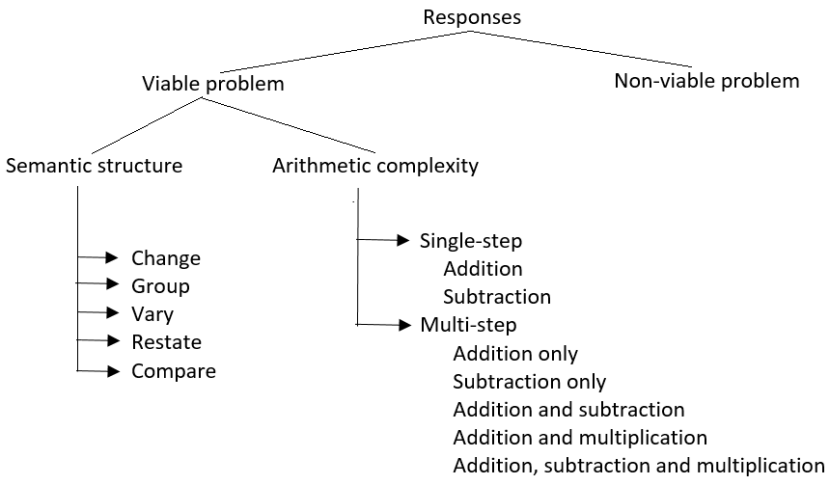

Figure 2. Schema related to the analysis of the problems posed by the students.

According to Figure 2, the mathematical complexity of the all valid problems was first analyzed according to semantic structures developed by Marshall (1995): *change*, *group*, *compare*, *restate*, and *vary* (a detailed description is presented in the section on the mathematical complexity of word problems). *Compare* and *vary* situations were not observed in the problems posed by the students. In this context, semantic structures of the posed problems were analyzed according to the *change*, *group*, and *restate* situations, and the number of semantic structures in each problem posed was determined. For example, if there were three semantic structures in the form of *change*/*change*/*group*, the semantic complexity of the problem would be coded by receiving three points. In this way, the complexity score of the problems that each student posed for Ecrin and Kerem was calculated. S_{11} posed the following problem for Kerem in SSPP task: *Teacher asks these three students to find their total amount of marbles and, then give him 43 of them. Accordingly, how many marbles do three friends have left?* In this problem, the total number of marbles corresponds to *the group* semantic structure, and removing 43 marbles from the total number of marbles corresponds to the *change* semantic structure. Since there are two semantic structures for this problem, its semantic complexity was coded with 2 points. Sample responses and explanations for these semantic structures are presented in the findings section.

Secondly, the problems were analyzed according to their arithmetic complexity and whether they were single-step or multi-step problems (see Figure 2). Regardless of the type of operation, problems that could be solved in one step were coded with one point, and multi-step problems were coded with two points. In addition, single-step and multi-step problems in the analytical process were also classified according to the types of operations they contained. In FPP task, S_4 wrote the following problem for Kerem*: Kerem has 987 marbles. He lost 567 of them. Then, his father bought 333 marbles for him. At the end, how many marbles does Kerem have?* The solution to this problem can be reached by the following operations respectively; 987-567=420 and 420+333=753. This problem is considered to be a multi-step problem and coded with 2 since it contains more than one arithmetic operation.

In order to determine whether there was a difference in complexity between the problems posed for Kerem and Ecrin, a Wilcoxon signed-rank test was applied, as the data were not distributed normally. In addition, the effect size was calculated when there were statistically significant differences between the posed problems. According to Cohen's (1988) interpretation of effect size, anything greater than .5 is large, .5–.3 is moderate, .3–.1 is small, and anything smaller than .1 is trivial. The students' responses to the problem-posing tasks were analyzed separately by two researchers. The researchers compared their analyses and reached a consensus on the classifications that differed. In addition, the findings include a presentation of direct quotations from students' responses to the questions asked during the interviews in order to explain possible differences between the problems posed for Ecrin and Kerem. These findings can provide evidence for the statistically determined results.

Findings

General Distribution of Problems the Students Posed

All students posed problems for Ecrin and Kerem. Taking into consideration the mathematical viability of the problems, one problem written for Ecrin was evaluated as non-viable. The non-viable problem of student S_{22} is as follows: *There are 500 liras in my coin bank. If I collected this money in a day, how much would I have on the second day?* The problem does not include any data on the amount of money in the coin bank on the second day. S_{22} wrote 500 + 500 next to the problem. Therefore, it seems that he tried to write a problem about how many liras he would have if he saved 500 liras in his coin bank on the second day. However, it was considered non-viable due to the fact that the operation was not mentioned in the wording of the problem.

Semantic Structure

One or more of the *change*, *group*, and *restate* situations were present in the students' problems in the viable category. The maximum number of semantic situations identified were three in the FPP task and five in the SSPP task. Sample problems in these categories are given in Table 2.

Table 2. Mathematical problem samples and their semantic structures

Ecrin	**Kerem**
There are 29 students in class 3/A, 30 students in class 3/C, and 32 students in class 3/D. What is the sum of the students in the three classes? [S_9: Group, FPP]	There are exactly 199 sheeps in Ali Baba's farm. Ali Baba's neighbor also has 100 sheeps. Accordingly, what is the total number of sheeps Ali Baba and his neighbor have? [S_9: Group, FPP]
There are 20 sheeps in a farm. 10 sheeps in the farm got sick, how many sheep are left? [S_2: Change, FPP]	Kerem has 10 sheep, 9 geese, and 8 chicks. Five of the chicks get lost. How many animals are left? [S_2: Change/Group, FPP]
Ali and his family collected 200 kilograms of tea leaves in the first day. In the second day, they collected 600 kilograms of tea leaves and gave 100 kilograms to his uncle. Accordingly, how many kilograms of tea leaves do they have at the end? [S_7: Change/Group, FPP]	Ömer raised a total of 304 TL on feast day. After the feast day, his father gave Ömer 50 TL. His mother gave him 4 TL more money than his father did. Accordingly, how many TL does Ömer have? [S_7: Change/Restate/Group, FPP]
Accordingly, what is the total number of marbles Ayşe, Burak and Zeynep have? [S_3: Group, SSPP]	Ayşe has 34 marbles, Burak has 27 marbles, and Zeynep has 23 marbles. Zeynep loses 7 marbles. Burak loses 3 marbles. What is the total number of marbles between them? [S_3-Change/Change/Group, SSPP]
The number of Görkem's marble is equal to the total number of Ayşe, Burak, and Zeynep's marbles. Accordingly, how many marble does Görkem have? [S_{14}: Restate/Group, SSPP]	If we find Ayşe, Burak, and Zeynep's total number of marbles and multiply it by 5, what will be the total number of marbles? Please find. [S_{14}: Restate/Group, SSPP]

According to Table 2, the problem written by S_9 for Ecrin in the FPP task is to combine three different groups to form a larger group. Thus, the problem only has a *group* situation. Since the problem that S_9 wrote for Kerem is to bring 199 and 100 sheeps together, it includes *group* situation. The problem written by S_2 for Ecrin in the FPP task includes the *change* situation since a certain part of the group is separated from it. In the problem that S_2 wrote for Kerem, the expression *5 of the chicks get lost* emphasizes *change*; in the last case, the total number of chicks, sheep, and geese emphasizes the *group* situation. In the problem written by S_7 in the FPP task for Ecrin, it includes *group* situation since it is about combining 600 kilograms and 200 kilogram of tea leaves. The problem includes *the change* situation due to the separation of 100 kilograms from the total amount of tea leaves. In the problem that S_7 wrote for Kerem, the expression *after the feast day, his father gave Ömer 50 TL* emphasizes *change*; the expression *his mother gave him 4 TL more money than his father did* emphasizes *restate*, as it denotes the relationship between quantities at a certain time. In the final case, the amounts of money are combined, thus emphasizing a *group* situation.

According to Table 2, S_3's problem for Ecrin in the SSPP task, which asks to calculate the total number of marbles between three people, is a *group* situation. In the problem written for Kerem by S_3, the loss of marbles by Zeynep and Burak emphasizes a *change* and the question of the total number of marbles the three have emphasizes a *group* situation. Lastly, in the problem written by S_{14} for Ecrin, the total number of marbles for Ayşe, Burak, and Zeynep includes *the group* situation and since Görkem's number of marbles is expressed over the total number of marbles, it includes *restate* situation. Since S_{14} used the same structure as the problem structure he wrote for Ecrin, the problem again includes both *the group* and *the restate* situations. The distribution of the problems posed for Ecrin and Kerem according to the number of semantic structures is given in Table 3.

Table 3. Distribution of posed problems according to the number of semantic structures

Number of Semantic Structures	FPP Task		SSPP Task	
	Ecrin	Kerem	Ecrin	Kerem
Zero	1(4)*	-	-	-
One	21(84)**	17(68)	17(68)	4(16)
Two	3(12)	6(24)	6(24)	15(60)

Three	-	2(8)	2(8)	5(16)
Four	-	-	-	-
Five	-	-	-	1(4)
Total	25(100)	25(100)	25(100)	25(100)

* Since one student could not write a viable problem for Ecrin, the number of semantic structures is considered to be zero.
** The data was calculated in frequency (percentage) over the number of students

According to Table 3, in the FPP task there were no more than two semantic structures in the problems written for Ecrin and no more than three semantic structures in the problems written for Kerem. In addition, only one semantic relation was observed in 84% of the problems posed for Ecrin, and this rate decreased to 68% for Kerem. In the SSPP task, up to five semantic structures were observed in the problems posed for Kerem. When the distributions are compared, 68% of the problems written for Ecrin included one semantic structure and 60% of the problems written for Kerem contained two semantic structures. Furthermore, according to the distributions in the table, more problems involving three or more semantic structures were written for Kerem.

According to the data in Table 3, students tended to produce more semantically complex problems for Kerem compared to Ecrin. According to the results of the Wilcoxon signed-rank test conducted to determine whether there was a statistically significant difference between the complexities of the problems, it was determined that there was in fact a significant difference on behalf of Kerem in free and semi-structured tasks (see, Table 4). The effect size of the differences in both problem-posing tasks was large.

Table 4. Wilcoxon signed-rank test results for the semantic complexity scores

Ecrin-Kerem	n	Rank mean	Rank total	z	p	r
SSPP task						
Negative ranks	1	6.00	6.00	-3.343	.001	.67
Positive ranks	15	8.67	130.00			
FPP task						
Negative ranks	0	.00	.00	-2.530	.011	.51
Positive ranks	7	4.00	28.00			

*p<.05

Arithmetic Complexity

The classification of the problems written for Ecrin and Kerem according to their arithmetic complexity is presented in Table 5.

Table 5. Distribution of arithmetic complexity of posed problems

Arithmetic Complexity	FPP Task		SSPP Task	
	Ecrin	Kerem	Ecrin	Kerem
Zero-step	1(4)*	-	-	-
Single-step				
Addition	3(12)**	5(20)	1(4)	1(4)
Subtraction	17(68)	12(48)	1(4)	-
Multi-step				
Only addition	1(4)	1(4)	18(72)	9(36)
Only subtraction	1(4)	1(4)	1(4)	-
Addition and subtraction	2(8)	6(24)	4(16)	12(48)
Addition and multiplication	-	-	-	2(8)
Addition, Subtraction and multiplication	-	-	-	1(4)
Total	25(100)	25(100)	25(100)	25(100)

* Since one student could not write a viable problem for Ecrin, arithmetic complexity is considered to be zero.
** The data was calculated in frequency (percentage) over the number of students

According to Table 5, 80% and 68% of the FPP task problems written for Ecrin and Kerem, respectively, are single-step problems. In the FPP task, more than two thirds of the problems written for Ecrin and about half of the problems written for Kerem involve single-step subtraction. Considering the distribution of multi-step problems, four problems were written for Ecrin and eight problems were written for Kerem. In the SSPP task, one and two of the problems written for Kerem and Ecrin, respectively, are single-step problems. Regarding the distribution of multi-step problems, while the problems written for Ecrin included addition and subtraction only, the problems written for Kerem also included multiplication. In addition, multi-step problems including only addition were written at a rate of 72% for Ecrin, whereas multi-step problems including addition and subtraction were written at a rate of 48% for Kerem.

According to the results of the Wilcoxon signed-rank test conducted to determine whether there is a statistically significant difference between the arithmetic complexities of the problems, it was determined that there is no significant difference in the FPP task and the SSPP tasks (see, Table 6).

Table 6. Wilcoxon signed-rank test results for the arithmetic complexity scores

Ecrin-Kerem	n	Rank mean	Rank total	z	p	r
SSPP task						
Negative rank	1	2.00	2.00	-0.577	.564	
Positive rank	2	2.00	4.00			
FPP task						
Negative rank	1	4.00	4.00	-1.890	.059	
Positive rank	6	4.00	24.00			

*p<.05

Findings Related to The Factors Students Took into Consideration When Posing Problems

The data obtained from the semi-structured interviews show that students considered Ecrin and Kerem's mathematical understanding when writing problems. Five of the students stated that they were trying to write easy problems for Ecrin and difficult problems for Kerem. It was determined that they changed the number and type of operations or the magnitude of the numbers in order to make the problems more difficult for Kerem. For example, while S_6 asked Ecrin for the total number of marbles, he wrote the following problem for Kerem.

> Ayşe has 34 marbles, Burak has 27 marbles, and Zeynep has 23 marbles. The number of marbles Mert has is 2 times the number of marbles Zeynep has. Then, Mert gives Zeynep 11 marbles, since he had more. How many marbles do Mert and Ayşe have? [S_6: Restate/Change/Group]

S_6 stated that he took into consideration the mathematical understanding and changed the operation type accordingly:

Researcher (R): How did you think while writing problems for Ecrin?
S_6: Ecrin is not good at operations. I wrote her an easier, simple, and quick problem.
R: How did you think while writing problems for Kerem?
S_6: Kerem is very good at mathematics. He does all the operations very fast. I wrote more difficult questions for him.
R: Are there any differences between the problems you wrote?
S_6: There are differences, but there are a few things that are the same. There is addition in both problems. As for the difference, there is multiplication in Kerem's problem.

S_{15} asked for the total number of marbles in a problem posed for Ecrin, while doubling the total number of marbles for Kerem in the SSPP task. The solution to the problem written for Ecrin can be reached with two addition steps (34 + 27 + 23 = 84). However, the solution to the problem written for Kerem is reached with two addition steps (34 + 27 + 23 = 84) and one multiplication step (2 × 84 = 168). Both problems were considered to be multi-step, as they included more than one arithmetic operation. However, the types of operations they had

were different. The student's explanation for this difference was as follows: *Because Ecrin is bad at addition, I asked her an addition problem to improve herself. Kerem is the president of mathematics club. He does operations fast. I added multiplication to make his question harder*.

S_{21} took the number magnitudes and numbers of operations into account in both problems posed for Ecrin and Kerem. But she chose one of them according to the task type. For example, the problems posed for Ecrin and Kerem in SSPP task were as follow:

> If Ayşe, Burak and Zeynep combine their marbles, how many marbles will there be? (for Ecrin)
>
> If Ayşe losts her 18 marbles, how many marbles will they all have? (for Kerem)

S_{21} wrote a problem for Ecrin that can be solved by addition operation. The problem she wrote for Kerem requires subtraction as well as addition. In this respect, it increased the number of operation types in the problem written for Kerem. In her explanations, S_{21} pointed out that Ecrin's mathematics knowledge was weak and Kerem's mathematics knowledge was good. Thus, while writing a problem, she emphasized that she wrote an easy problem for Ecrin and a difficult problem for Kerem. In addition, she stated that she increased the number of operations in order to make the problem more difficult. The interview with S_{21} is as follows:

R: How did you think while posing the problem for Ecrin?
S_{21}: Ecrin is not good in mathematics. For this reason, I wrote a simpler problem for Ecrin. .
R: How did you think while writing the problem for Kerem?
S_{21}: Kerem is very good in mathematics. For this reason, I wrote a difficult problem for Kerem.
R: Can you explain the difficulty differences?
S_{21}: I posed a simpler problem for Ecrin. But I posed a harder problem for Kerem. Ecrin's problem involves less operation, while the Kerem's problem involves more operations.

Similarly, in the FPP task, S_{21} took into account the difference in mathematics successes between the students. Unlike the SSPP task, the magnitude of the numbers changed in this task instead of increasing the number of operations. In addition, S_{21} emphasized that she likes marbles and, therefore, creates the story of the problem by taking into account the situations she likes. The two problems posed by S_{21} and the interview conducted was as follows:

> Yaprak had 29 marbles. She gave 18 of them to her friend Öykü. How many marbles did Yaprak have left? (for Ecrin)
>
> There were 999 cows in Ali Baba's farm. Ali Baba sold 786 cows. How many cows left were there for Ali Baba? (for Kerem)

R: What did you think when posing problem?
S_{21}: In the problems I wrote, the quality and whether it can really be solvable.
R: You paid attention. So, was there any difference between the problems you posed for Kerem and Ecrin?
S_{21}: Yes, there is.
R: What is it?
S_{21}: I asked Kerem's problem harder. This is because Kerem is good at mathematics. But, since Ecrin is somehow worse, I asked simpler problem.
R: So, what was the difference for you?
S_{21}: I asked only from two-digit numbers for Ecrin. The reason why I asked from marbles is that I like marbles. But, I asked problem for Kerem from three-digit numbers.

S_1 stated that he only took into account the magnitude of the numbers while differentiating the problems in the FPP task. He posed a problem with two-digit numbers for Ecrin, but posed a problem with three-digit numbers for Kerem because of his higher mathematical ability level. The problems written by the student and his explanation were as follows:

> My friend has 55 marbles. He gave me 44 of 55 marbles. How many marbles does my friend have now? (for Ecrin)
>
> I have 650 toy cars. I gave Kerem 499 toy cars. How many toy cars do I have left? (for Kerem)

> Explanation: Ecrin cannot do addition very well, so I wrote the problem with small numbers. Kerem does addition and subtraction fast.

In the interviews, it was determined that S_{23} took Ecrin's and Kerem's interests into consideration in addition to the mathematical structures while writing the problems. He posed a problem for Kerem about reading a book which used three-digit numbers and was solved by subtraction. He made the following statement about the problem: *Kerem likes reading books very much, so I wrote the question about reading books.* On the other hand, S_{24} took only Ecrin's and Kerem's interests into account while writing problems. She wrote problems including subtraction for both Ecrin and Kerem. The explanations she gave for the problems he wrote were as follows: *I asked Ecrin the number of hairgrips as she likes hairgrips. … I asked Kerem this question because he likes cars.*

Discussion and Conclusions

The worldwide recommendations for the reform of school mathematics suggest that problem posing has an important role (Chen, Van Dooren & Verschaffel, 2015). Studies on problem posing have not been yet one of the main subject of mathematics education research, and that more research is needed about students' cognitive processes (Cai et al., 2015). The purpose of this study was to expand the field's knowledge about students' understanding related to problem posing by examining what factors third grade students took into consideration when posing problems for their peers, and how these factors affected the complexities of the problems.

It was determined that all third grade primary school students wrote problems for Ecrin and Kerem for both tasks and almost all of the problems written were valid problems. These results indicate that students' performance of writing valid problems is high. Only one problem written for Ecrin at the FPP task was considered to be mathematically invalid. The student was unable to express the addition operation in the story of the problem. However, he was able to express the addition operation in the problem he wrote for Kerem. These data indicate that the student had difficulty in verbally expressing mathematical expressions. Problem-posing performance is also affected by writing ability (e.g., Çetinkaya & Soybaş, 2018; Kwek, 2015; Özgen, Aydın, Geçici & Bayram, 2019). For example, Kwek (2015) found that seventh-grade students were not generally aware of the difference between writing for a problem and writing for a solution. He concluded that the resulting unsolvable mathematical problems on inequality reflected the students' difficulties with enriching the content of the problem statements. Similarly, Özgen et al. (2019), who investigated eight grade students' performances to different problem posing tasks, indicated that students' inability to write and explain what they think significantly affected their success in problem posing. However, in our study, there was only one invalid problem resulting from a student's writing ability, indicating that this is not an important issue. Stickles (2011) indicated that the complexity of data used in the activity has an effect on problem-posing performance. Thus, not presenting complex relational data in the problem-posing activities might be the reason that invalid problems did not arise from the students' writing skills. In addition, students might have given up writing some problems due to possible difficulties experienced when expressing their thoughts. Although no such explanation was encountered in the interviews conducted with six students, this situation might have been encountered by some other students. This should be investigated in more detail with qualitative approaches.

The studies (e.g., Kar, 2015; Kılıç, 2013; Luo, 2009) investigating the semantic structures of the problems posed by students shows that some semantic structures were more prominent than others. For example, Kılıç (2013) determined that fourth and fifth grade students had tendencies to pose problems regarding the meaning of the combining for addition and the meaning of separation for subtraction. This study, parallel to the results in the related literature, found that some semantic structures were used more compared to the others. In both problem-posing tasks, the problems posed for Ecrin and Kerem were observed to utilize the *change*, *group*, and *restate* semantic structures. In this study, the limited mathematical background of the students might be the main reason why they could not write problems that involved the *compare* and *vary* structures. According to Marshall (1995), *compare* situations require determining whether the larger or smaller value is expected when expressions such as "quicker," "longer," "better buy," or "less costly" are used, and *vary* situations require functional thinking. Accordingly, *compare* situations can be created by means of addition and subtraction operations. Although students received instructions for addition and subtraction operations, the reason why they did not pose problems involving *compare* situations could be due to the fact that these kinds of semantic structures are not sufficiently included in their learning environment. It is not possible to explain this situation with the findings of this study. Therefore, further studies should investigate the semantic structures of the problems that are posed in mathematics lessons and found in textbooks. However, the fact that the *vary* situation is expressed through multiplicative relations and the students were still at the beginning stage of learning multiplication reveals why it was not seen in the problems. Furthermore, Yeap and Kaur (2001) stated that it is more difficult for third- and

fifth-grade students to solve problems of *restate* situations compared to *group* situations for one-step problems. In this study, although the mathematics backgrounds of the third-grade students were quite limited, the fact that they wrote problems including the *restate* situation indicates their flexible thinking skills.

It was determined that there was a difference between the semantic structures of the problems posed for Ecrin and Kerem in both problem-posing tasks, and their effect size was at the large level. These results suggest that students write more semantically complex problems for peers that they consider to be more mathematically proficient. In addition, the students posed problems including more semantic structures in the SSPP task compared to the FPP task. Presenting open-ended stories in the SSPP task increased the number of semantic structures by further encouraging the linking of data.

Considering the arithmetic complexities of the problems posed for Ecrin and Kerem, it was found that there were more similarities than differences between the problems. The fact that a large percentage of the problems written for Ecrin and Kerem were single-step problems in the FPP task and multi-step problems in the SSPP task resulted in no statistically significant differences in arithmetic complexity. The main reason for changing the number of operations in the FPP and SSPP tasks was the format of the tasks. The fact that the number of marbles of each of the three persons was given in advance in the SSPP task directed the students to ask for the total number of marbles. This type of problem was preferred in the problems written for Ecrin; therefore, they were multi-step problems. The students' tendency to write problems that were more difficult for Kerem because of his success caused them to further develop the problems they wrote for Ecrin. Therefore, the problems written for Kerem were also multi-step problems. In addition, although the statistical test results did not show a significant difference between the arithmetical complexities of the problems posed for Kerem and Ecrin, problems involving multiplication operation were posed only for Kerem. These results indicate that the students did take into consideration the mathematical understanding of their classmate when posing problems.

According to the qualitative findings of this study, some results were obtained from the explanations regarding the problems posed for Ecrin and Kerem. First, the difference in mathematical success between Ecrin and Kerem was a dominant criterion during the problem-posing process. Moreover, Ecrin's and Kerem's interests were another common aspect that students took into consideration. Some students wrote problems after considering both factors. In such situations, the idea of posing more complex problems for Kerem was preserved and the context of the problem was determined according to the students' interests. In this aspect, the humanistic perspective (Chapman, 2012), in which the interests of the problem posers were taken into account, was utilized while posing the problems. Secondly, while posing complex problems, the students mainly considered the type and the number of operation and the magnitude of the numbers. In addition, changing the operation type was taken into consideration more than increasing the number of operations in posing more complex problems. While writing a problem for Kerem, the students tried to add a new type of operation to the operations required for solving the problem written for Ecrin. In this respect, it was understood from the students' perspective that the more complex problem meant the problems involving more and different types of operations.

Furthermore, Chapman (2012) indicated that producing problems should have a purpose of contributing to the students' learning (the utilitarian perspective). This perspective was also observed in third-grade students' problems posed for Ecrin and Kerem. Pointing out the operation type that Ecrin struggles with, some students wrote problems that included it in order to help her improve. Similarly, since Kerem was better in mathematics, students wrote problems with more operation types or larger numbers for him. In this way, the students pointed out that Kerem could practice more to improve further. Finally, unlike the perspectives that Chapman (2012) discussed, a new understanding was determined among third-grade students. According to this understanding, some students posed simpler problems for their friends in order for them not to experience feelings of failure while solving them. This was evident in the problems posed for Ecrin, because the students understood that her mathematics success was low.

This study can offer many potential contributions to the use of problem posing in mathematics education. If the problems and exercises posed are too easy, then opportunities for students to develop more sophisticated approaches are delayed (Downton & Sullivan, 2017). Students' posing of problems with different numbers and types of semantic relations for their friends can be turned into opportunities by teachers to enrich the learning environment, exposing students to many different word problems. Analyzing problems involving many more semantic relations gives opportunities to make more inquiries among the data provided by problems in the classroom environment. Additionally, in his famous book, *How to Solve It*, Polya (1957) indicates that "the student should also be able to point out the principal parts of the problem, the unknown, the data, the condition" (p. 6). In this context, students' sharing of problems involving different semantic relations can help them to understand word problems and, therefore, contribute to their problem-solving ability.

Teachers should think about not only the mathematical aspects but also the pedagogical aspects of the activities they use. Problems or activities should help teachers to learn about their students' mathematical thinking (Crespo & Sinclair, 2008). Teachers can use the activities of this study to determine students' mathematical understanding and the contexts in which they are interested. The semi-structured interviews indicated that students changed the magnitude of the number and the number and type of operations for students with different mathematical understanding. Thus, the problems written by students for their friends will give teachers an idea about the kinds of problems that students perceive as easy or difficult. Moreover, some students stated in the semi-structured interviews that they posed problems about topics in which their friends were interested. By means of such activities, teachers will be able to determine their students' interests and benefit from this knowledge in their teaching agenda.

This study may also aid researchers who are working in the field of problem posing. In this study, the complexities of the problems posed by the students for their friends differed. Therefore, it was understood that the activity directives were also effective in influencing the students' problem-posing performance in addition to the designed instructional methods or activity format. Students have been asked to pose problems for their friends in experimental (e.g., Cankoy, 2014; Kopparla et al., 2019) and correlational studies on problem posing (e.g., Silver & Cai, 1996; Yeap & Kaur, 2000). However, no explanation was given for situation (i.e., posing problems for their friends) that might have an effect on the problem-posing performance difference. Therefore, mathematics education researchers are advised to consider the effect of the "pose problems for your friends" directive on the complexity while designing problem-posing studies or interpreting the results of similar studies.

Any generalizability of the results of the current study will be limited for several reasons. The study was conducted with 27 third-grade students. Increasing the sample size would provide more reliable results for statistical analysis. In this study, it was determined that students mainly utilized the humanistic and utilitarian perspectives—as mentioned in Chapman's (2012) study—when posing problems. In future studies, conducting interviews with more students will be able to provide more information about the perspectives that students utilize when posing different problems. In this study, one of the students was chosen by the teacher from the students with high mathematical performance while the other was chosen from those with low performance. This situation is another limitation of this study. There is a need to investigate whether there is a difference between the complexities of the problems posed for those whose mathematical performance is similar and for those whose mathematical performance is dissimilar. Additionally, having the teacher make the determination about Ecrin's and Kerem's mathematical understanding can be seen as another limitation of the study. Determining students' mathematical understanding using a more objective assessment tool may make a stronger contribution to the validity of the results of the study. Finally, this study included two problem-posing tasks in free and semi-structured formats. Three non-relational numerical data figures were included in the SSPP task, taking into consideration the students' mathematical level. Problem-posing tasks that can be amended by changing the amount of data will be able to provide more enlightening information about how problems are posed for students of different ability levels.

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International Journal of Contemporary Educational Research (IJCER)

www.ijcer.net

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To cite this article:

Ocak, G., Doğruel, A. B., & Tepe, M. E. (2021). An analysis of the relationship between problem solving skills and scientific attitudes of secondary school students. *International Journal of Contemporary Educational Research*, *8*(1), 72-83. DOI: https://doi.org/10.33200/ijcer.780710

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International Journal of Contemporary Educational Research
Volume 8, Number 1, March 2021, 72-83 ISSN: 2148-3868

An Analysis of the Relationship between Problem Solving Skills and Scientific Attitudes of Secondary School Students

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Abstract

This study was carried out to examine the relationship between secondary school students' problem-solving skills and scientific attitudes in terms of gender, class level and education level of the parents. In the study, correlational research model, which is among the general survey models, was employed. The sample of the study consisted of 560 students selected from the secondary schools in Afyonkarahisar Province, Turkey by using convenience sampling method. In the study, Problem Solving Inventory for Children (PSIC) and Scientific Attitude Scale (SAC) were applied to collect the data. In the analysis of the data, Pearson correlation analysis, one-way variance analysis and two-way variance analysis were performed. As a result of the analyses, a negative and low-level relationship was found between secondary school students' problem-solving skills and scientific attitudes. While there was a negative and low-level relationship in terms of female students, it was found that this relationship was not significant for male students. When analyzed in terms of class level and maternal education level, it was concluded that this relationship was not significant. It was concluded that problem solving skills and gender did not have a significant and common effect on students' scientific attitudes. Similarly, it was concluded that problem solving skills and class level did not have a significant and common effect on students' scientific attitudes. There was no significant difference between middle school students' scientific attitudes in terms of problem-solving skill levels. In addition, it was determined that students' problem-solving skills were not a significant predictor of their scientific attitude.

Key words: Problem-solving skills, Scientific attitude, Secondary school students

Introduction

In the 21st century, students have to get an education at a level that can keep up with changes and developments. Students face numerous and varied problems in the different social environments they are in, as well as in their own private area. Students need to use problem solving skills to cope with these problems. Moreover, human beings encounter some problems not only in their childhood but also in every period of their lives. To continue life in a healthy and orderly manner, individuals must eliminate the problem situations they encounter. According to Erden (1998: 52), people need to have problem solving skills to adapt to social life and change, to be successful and independent. People develop an attitude towards the situation, person, or objects because of the learning that takes place according to their knowledge and interests in the process of producing solutions to the problems they encounter. Among the objectives of the Science Curriculum in Turkey, it is stated that students should develop curiosity, attitude and interest in the events that occur in nature (Ministry of National Education [MoNE], 2018:4). Therefore, it can be understood clearly that scientific attitude is important in education.

The complex situations that individuals experience can be considered as a problem (Polat & Tümkaya, 2010: 348). Moreover, any difficulties felt and desired to be eliminated can be a problem (Karasar, 2016: 81). Problem solving can be defined as the process of eliminating the difficulties encountered. According to another definition, it is a complex process in which cognitive, affective, and behavioral skills are used, and the people go through from feeling the problem to finding a solution to the problem. (Demirtaş & Dönmez, 2008: 183). Ocak and Eğmir (2014: 29) stated that problem solving is a skill that provides personal development and effective

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learning. In this case, problem solving skill can be described as one of the most important skills that a person must achieve to produce solutions in problem situations.

It is seen that the concept of attitude is handled in different ways. Attitude is expressed as a fact gained through learning, guiding the behavior of the individual and causing bias in decision making process. Thurstone (1931), on the other hand, defined the attitude as "a positive or negative density ranking and grading towards a psychological object" (Tavşancıl, 2010). Scientific attitude has been defined by Jayasree and Rao (1999) as investigative considerations and behaviors that facilitate to find a solution for problems, come up with information, and transfer the research competences into experience. According to Rani and Rao (2000), scientific attitude is the disposition look for the truth, think rationally and behave sensibly (Çakır, 2012: 23). Therefore, it can be said that we need to have those attitudes and behaviors to continue both our education life and our daily routine. According to Başaran (1988: 300), a person with a scientific attitude is willing to recognize and solve the situation or problem he/she faces; designs several ways to solve the problem and starts to question one of these ways; evaluates the outcome of the actions. In this context, Bingham (1976: 11) stated that problem solving skill is related to attitude. The scientific attitude adopted by the individual in the problem-solving process enables the problem to reach rational solutions. Students who have a scientific attitude in solving a problem can recognize the problem and try different solutions. For this reason, students with strong scientific attitude are expected to have problem solving skills. Similarly, students with high level problem-solving skills are expected to have strong scientific attitudes. In this aspect, it can be thought that there may be a relationship between problem solving skill and scientific attitude.

When the literature is examined, many studies with respect to problem-solving skills and scientific attitude have been found (Korkut, 2002; Osborne, Simon & Collins, 2003; Terzi, 2003; Saygılı, 2010; Totan, 2011; Özden, 2012; Gömleksiz & Bozpolat, 2012; Canpolat, Kazak Çetinkalp & Özkaşer, 2013; Koç, 2014; Yu, Fan & Lin, 2015; Mahulae, Sirait & Sirait, 2017; Karahan, 2018; Puspita, 2018). However, there is no study investigating the relationship between problem-solving skills and scientific attitude of the secondary school students. In this respect, it can be said that the research is an original study. For this reason, literature review is handled separately in terms of topics.

Numerous studies were found in the literature review related to problem-solving skills. While some of them studied the problem-solving skills of students, teachers, or prospective teachers in terms of various variables, some of them examined the relationship between problem-solving skills and another variable. For example, Canpolat, Kazak Çetinkalp and Özkaşer (2013) investigated problem-solving skills of 2nd class primary school students and classroom climate in a physical education class. While Terzi (2003) conducted a study on the 6th class students' interpersonal problem-solving skills perceptions, Karahan (2018) studied high-school students' problem-solving skills and life satisfaction. On the other hand, Gömleksiz and Bozpolat (2012) evaluated the opinions of the 4th and 5th class students on problem-solving skills; Korkut (2002) examined the problem-solving skills of high school students. Saygılı (2010) examined the effect of effective use of instructional technologies in science and technology lessons on problem solving skills of primary school students and some other variables. Also, Totan (2011) examined the effect of the problem-solving skills training program on the 6th class primary school students' social-emotional learning skills. Similarly, relational studies on problem-solving skills are also included in the literature. Uysal (2007) conducted a study on the relationship between secondary school students' problem-solving skills, anxieties, and attitudes towards mathematics lesson. On the other hand, Öner (2019) investigated the relationship between secondary school students' attitude towards STEM, perception, problem-solving and questioning learning skills in his master's thesis; Gözcü Reyhan (2018) examined the relationship between the creative thinking tendencies, perceptions of problem-solving and academic achievement of the 8th class students of primary education; Gülen (2017) carried out a study on the relationship between adolescents' problem-solving skills and cyberbullying coping behavior. Also, Derin (2006) surveyed the relationship between problem-solving skills, locus of control, and academic achievement of elementary school 8th class students. In addition, while Demirtaş and Dönmez (2008) preferred to work with teachers in secondary education, Ocak and Eğmir (2014) carried out their study with prospective teachers; Polat and Tümkaya (2010) investigated their research with students studying at classroom teaching program; Akyol (2019) conducted his study with students of education faculty.

Besides that, various quantitative and qualitative studies have been conducted to determine the scientific attitude such as scientific attitudes of primary school students (e.g. Afacan, 2008; Mıhladız & Duran, 2010), of gifted girl students (e.g. Camcı Erdoğan 2013), of secondary school students (e.g. Kılıç, 2011; Sekar & Mani, 2013; Kalaivani & Pugalenthy, 2015; Ocak, Ocak & Olur, 2021) and of prospective teachers studying in Abu Dhabi (e.g. Önen Öztürk, 2016). While Çakır (2012) investigated the relationship between classroom teachers' opinion on the nature of science, scientific attitude and science self-efficacy levels, Çelik and Onay (2014) conducted

their study on the 6th class students' scientific attitudes and self-confidence; Ergin and Özgürol (2011) surveyed the relationship between scientific attitude and emotional intelligence. On the other hand, Özden (2012) researched on the views and scientific attitudes of secondary school students towards scientific knowledge in terms of various variables; Uzun (2011) examined the views of the 5th class students towards scientific knowledge and their attitudes towards Science. Demirbaş and Yağbasan (2011) conducted a study on the effect of 2005 Science and Technology Curriculum in the development of scientific attitudes of primary school students. It is seen that both scientific attitude and problem-solving skills are examined separately in terms of different variables.

Problem Statement and Importance of the Study

Rapid changes and developments in science and technology caused by the millennium age cause people to face different situations and problems in a wide range of environments. Individuals with problem-solving skill can solve their problem situations and create a balanced situation again. Individuals with a high level of problem-solving skills can easily cope with the problems they come upon. In addition, to keep up with the rapid changes and developments in science and technology, the scientific attitude levels of individuals should be high since scientific attitude help individuals to keep up with the changes and benefit from the advantages provided by technology. Based on the understanding that school is life itself, it is among the general aims of education to develop the ability of individuals to find solutions to the problems they will encounter throughout their lives and a positive attitude towards science. Scientific attitudes of students are thought to improve their problem-solving skills, knowledge production skills and research tendencies. For this reason, knowing the relationship between students' problem-solving skills and their scientific attitudes, and the factors affecting this relationship may be a source for the studies of organizing and developing the educational environment and curriculum content.

In this study, it is aimed to examine the relationship between problem solving skills and scientific attitudes of secondary school students in terms of gender, class level and parental education level variables.

Following sub-questions guided throughout the study:

Sub questions:
1) What is secondary school students' problem-solving skills level?
2) What is secondary school students' scientific attitudes level?
3) Is there a significant relationship between problem-solving skills and scientific attitudes of secondary school students?
4) Is there a significant relationship between secondary school students' problem-solving skills and scientific attitudes in terms of gender?
5) Is there a significant relationship between secondary school students' problem-solving skills and scientific attitudes in terms of class level?
6) Is there a significant relationship between secondary school students' problem-solving skills and scientific attitudes in terms of their mothers' education level?
7) Is there a significant relationship between secondary school students' problem-solving skills and scientific attitudes in terms of their fathers' education level?
8) Do the problem-solving skills and gender variable have a significant and common effect on the scientific attitudes of secondary school students?
9) Do the problem-solving skills and class level variables have a significant and common effect on the scientific attitudes of secondary school students?
10) Is there a significant difference between the scientific attitudes of secondary school students in terms of their problem-solving skills levels?
11) Are secondary school students' problem-solving skills a predictor of their scientific attitudes?

Method

Research Design

This study, which is conducted to investigate the relationship between students' problem-solving skills and scientific attitudes in terms of various variables, employed a correlational research model. Correlational research models purpose to specify the existence or degree of variance between two or more variables (Karasar, 2016: 114).

Population and Sampling

This research was studied with 653 students from 5th, 6th, 7th, and 8th class studying at four different secondary schools in Afyonkarahisar Province, Turkey in the 2016-2017 academic year. For the sample to represent the population, the study was carried out with 560 secondary school students who were appropriate at the 95% confidence level (Büyüköztürk et al., 2016: 85). The population of study is the secondary school students in Afyonkarahisar Province, Turkey. In the study, convenience sampling method, one of the simple random sampling methods, was used in order to reach a large number of students in a short time, in the most accessible way, and to select an unbiased study group.

Table 1: Sample Distribution

Variable	Type	N
Gender	Female	311
	Male	249
	Total	560
Class	5	103
	6	125
	7	167
	8	165
	Total	560

Data Collection Tools

In the study, the data were gathered by the Problem-Solving Inventory for Children (PSIC) improved by Serin, Bulut Serin and Saygılı (2010) to determine the problem-solving skills of secondary school students and the Scientific Attitude Scale (SAS) developed by Moore and Foy (1997) and Demirbaş and Yağbasan (2006) adapted it to Turkish by to identify their scientific attitudes. PSIC comprise of 24 items and 3 sub-dimensions. These 3 sub-dimensions are trust to problem-solving skill (12 items), self-control (7 items), and avoidance (5 items). The validity and reliability test of the inventory was conducted, and the Cronbach Alpha reliability coefficient was 0.86, and it was stated that all the sub-dimensions of the scale were reliable (Serin, Bulut Serin & Saygılı 2010: 455). The items in the inventory were prepared in a 5-point Likert type and the tendency of the individuals to show the behaviours stated in the items; 1: I never behave like this, 2: I rarely behave like this, 3: I behave like this once in a while, 4: I behave like this frequently, 5: I always behave like this.

Scientific Attitude Scale was translated into Turkish and then presented to the expert for its proficiency in terms of language, content, and scope. The scale consists of 6 sub-dimensions. These 6 sub-dimensions are scientific laws and structure of theories, having scientific behaviour, the structure of science and its approach to the cases, the structure and objective of science, the place, and importance of science in society, and eagerness to exercise scientific studies. The items were prepared in a 5-point Likert type and the degree of people's participation in the items was classified as "I strongly agree", "I agree", "I am neutral", "I disagree" and "I strongly disagree". 20 of the items in the scale were determined as positive and 20 as negative. Negative items were reversed during analyses. As a result of the reliability analysis of the scale, the Cronbach Alpha reliability coefficient was 0.76, and Spearman-Brown two-half correlation was found as 0.84.

Data Analysis

The scales and personal information form were applied to 653 secondary school students. However, it was seen that some of the forms were incomplete. Therefore, the analyses were conducted on 560 scale forms. The valid response rate was 85 %. The data obtained from the scales were analysed in a computer environment by means of a statistical program. The lowest average score that can be obtained from the scales is 1. The highest score is 5. In the analysis conducted in the study, the level of significance was accepted as .05.

Findings and Interpretation

Sub problem 1: What is the secondary school students' problem-solving skills level?

The scores obtained from the problem-solving skills scale are shown in Table 2.

Table 2: Secondary School Students' Problem Solving Skills Level

Scale and Sub-Dimensions	$\bar{x}$	sd
Trust to Problem-Solving Skills	3.76	.75
Self-Control	3.47	.83
Avoidance	4.05	.73
Total	3.74	.62

In Table 2, the mean value of secondary school students' problem-solving skills level related to the sub-dimensions is at the medium level ($\bar{x}$ = 3.76, $\bar{x}$ = 3.47, $\bar{x}$ = 4.05). With the examining the general score that the students had, it was clear that the students had a high level of skill as the other sub-dimensions.

Sub problem 2: What is secondary school students' scientific attitudes level?

The scores obtained from the scientific attitude scale are shown in Table 2.

Table 3: Secondary School Students' Scientific Attitude Level

Scale and Sub-Dimensions	$\bar{x}$	sd
Scientific Laws and Structure of Theories	2.69	.55
The Structure of Science and Its Approach to Cases	2.84	.52
Having Scientific Behaviour	2.80	.59
The Structure and Objective of Science	2.10	.64
The Place and Importance of Science in Society	3.87	.84
Eagerness to Exercise Scientific Studies	2.66	.43
Total	2.71	.37

In Table 3, the mean value of secondary school students' scientific attitude level related to the sub-dimensions is at the medium level ($\bar{x}$ = $\bar{x}$ = 2.69, $\bar{x}$ = 2.84, $\bar{x}$ = 2.80, $\bar{x}$ = 2.10, $\bar{x}$ = 3.87, $\bar{x}$ = 2.66). With the examining the general score that the students had, it was clear that the students had a medium level of skill as the other sub-dimensions.

Sub problem 3: Is there a significant relationship between problem-solving skills and scientific attitudes of secondary school students?

Pearson correlation test was used to investigate the relationship between problem-solving skills and scientific attitude.

Table 4: Correlation Analysis Result

	N	Pearson Correlation	p
Problem Solving Skills	560	-,09	,02
Scientific Attitude	560		

As can be seen in table 4, there is a significant relationship between secondary school students' problem-solving skills and scientific attitude (p = .02; p < .05). It was found that this relationship was negative and low (r = -.09; r < .30).

Sub problem 4: Is there a significant relationship between secondary school students' problem-solving skills and scientific attitudes in terms of gender?

A partial correlation test was used to examine the relationship between problem solving skills and scientific attitudes in terms of gender variable.

Table 5: Partial Correlation Test Result in Terms of Gender

		Pearson Correlation	p	N
Female	Problem Solving Skills Scientific Attitude	-.11	.04	311
Male	Problem Solving Skills Scientific Attitude	-.07	.23	249

As a result of the analysis, there was a significant relationship between the problem-solving skills and scientific attitudes of female students ($p = .04$; $p < .05$). This relationship is negative and low ($r = -.11$; $r < .30$). However, the relationship between male students' problem-solving skills and scientific attitudes was not significant ($p = .23$; $p > .05$).

Sub problem 5: Is there a significant relationship between secondary school students' problem-solving skills and scientific attitudes in terms of class level?

A partial correlation test was used to analyse the relationship between problem solving skills and scientific attitudes in the sense of class-level variable.

Table 6: Partial Correlation Test Result in Terms of Class Level

			Pearson Correlation	p	N
Class Level	5	Problem Solving Skills / Scientific Attitude	.00	.97	103
	6	Problem Solving Skills / Scientific Attitude	-.08	.35	125
	7	Problem Solving Skills / Scientific Attitude	.03	.67	167
	8	Problem Solving Skills / Scientific Attitude	-.09	.22	165

In respect of the analysis results obtained in table 6, there was no significant relationship between secondary school students' problem-solving skills and scientific attitudes in the sense of class level variable ($p > .05$).

Sub problem 6: Is there a significant relationship between secondary school students' problem-solving skills and scientific attitudes in terms of their mothers' education level?

Partial correlation test was used to analyse the relationship between problem-solving skills and scientific attitudes in terms of mothers' educational level variable.

Table 7: Partial Correlation Test Results in Terms of Mothers' Education Level.

			Pearson Correlation	p	N
Mother Education Level	Primary School	Problem Solving Skills / Scientific Attitude	-.13	.14	121
	Secondary School	Problem Solving Skills / Scientific Attitude	-.05	.40	204
	High School	Problem Solving Skills / Scientific Attitude	-.13	.11	135
	University	Problem Solving Skills / Scientific Attitude	-.06	.55	100

As a result of the analysis, it was obtained that the relationship between secondary school students' problem-solving skills and scientific attitudes was not significant in terms of their mothers' education level ($p > .05$).

Sub-problem 7: Is there a significant relationship between secondary school students' problem-solving skills and scientific attitudes in terms of their fathers' education level?

A partial correlation test was used to analyse the relationship between problem-solving skills and scientific attitudes in the sense of fathers' education level variable.

Table 8: Partial Correlation Test Results in the Sense of Fathers' Education Level.

			Pearson Correlation	p	N
Father Education	Primary School	Problem Solving Skills / Scientific Attitude	-.25	.06	63

Level	Secondary School	Problem Solving Skills Scientific Attitude	-.13	.19	100
	High School	Problem Solving Skills Scientific Attitude	-.06	.39	201
	University	Problem Solving Skills Scientific Attitude	-.06	.37	196

As a consequence of analysis, the relationship between secondary school students' problem-solving skills and scientific attitudes was not significant in the sense of their fathers' education level ($p > .05$).

Sub problem 8: Do the problem-solving skills and gender variable have a significant and common effect on the scientific attitudes of secondary school students?

To analyse the common effect of the problem-solving skill variable and gender variable on scientific attitude, two-way analysis of variance was performed.

Table 9: Two-Way Analysis of Variance (ANOVA) Results

Source of Variance	Sum of Squares	df	Mean of Squares	F	p	η^2
Problem Solving Skills	376.89	2	188.44	.82	.44	.00
Gender	243.19	1	243.19	1.05	.30	.00
Problem Solving Skills *Gender	225.17	2	112.58	.49	.61	.00
Error	127208.36	554	229.61			
Total	6741997.00	560				

According to table 7, problem solving skills variable and gender variables do not have a significant and common effect on the scientific attitudes of secondary school students ($p > .05$).

Sub problem 9: Do the problem-solving skills and class-level variables have a significant and common effect on the scientific attitudes of secondary school students?

To analyse the common effect of the problem-solving skill variable and class level variable on scientific attitude, two-way analysis of variance was performed.

Table 10: Two-Way Analysis of Variance (ANOVA) Results

Source of Variance	Sum of Squares	df	Mean of Squares	F	p	η^2
Problem Solving Skills	20.79	2	10.39	.04	.95	.00
Class Level	5073.02	3	1691.00	7.65	.00	.04
Problem Solving Skills *Class Level	489.52	4	122.38	.55	.69	.00
Error	121558.78	550	221.01			
Total	6741997.00	560				

According to Table 8, problem-solving skills variable and class level variable do not have a significant and common effect on the scientific attitudes of secondary school students ($p > .05$).

Sub problem 10: Do the scientific attitudes of secondary school students differ in terms of problem-solving skills?

Independent samples t test was conducted to examine the effect of students' problem-solving skills on their scientific attitudes.

Table 11: Independent Samples t Test Results

		N	$\bar{x}$	S.D.	t	df	p
Problem Solving Skills	Low	252	2.73	0.40	1.19	558	.23
	High	308	2.69	0.35			

As a consequence of the analysis, no significant difference was found between the scientific attitudes of secondary school students according to their problem-solving skill levels ($p > .05$).

Sub problem 11: Are secondary school students' problem-solving skills a predictor of their scientific attitudes?

Regression analysis was done to test if problem-solving skill is a significant predictor of scientific attitude.

Table 12: Simple Linear Regression Analysis Results

	β	Standard Error β	R	R^2	Standardized β	t	F	p
Problem Solving Skills	-1.56	1.21	.05	.0025	-.05	-1.28	1.66	.19

As a consequence of the analysis, it was determined that the problem-solving skills of secondary school students were not a significant predictor of their scientific attitudes ($p = .19$; $p > .05$).

Conclusion-Discussion and Suggestions

This study was conducted to determine the relationship between secondary school students' problem-solving skills and scientific attitudes in the sense of various variables. According to the findings obtained in the study, there was a negative and low-level relationship between problem solving skills and scientific attitudes of secondary school students. Although the students' scientific attitude level is high, it can be said that they avoid finding solutions to problems. There are studies supporting the findings of this finding in the literature. Similarly, Derin (2006) stated that there was a negative relationship between problem solving skills, locus of control and academic achievements of the 8th class students in primary education. In a study conducted by Gülen (2017), it was found that there was a negative and low-level relationship between adolescents' problem-solving skills and coping behaviour with cyberbullying. In the study investigated by Gözcü Reyhan (2018), it was appeared that there was a negative and significant relationship between the 8th class students' creative thinking tendencies and their perceptions of problem solving. According to a study conducted by Öner (2019), there was a negative and significant relationship between secondary school students' problem-solving skills and STEM perceptions. Karahan (2018), found a negative relationship between problem solving skills and life satisfaction of high school students in his study. Apart from these, a significant relationship was found in other correlational studies conducted with the scientific attitudes of the students, but this relationship was found to be positive, unlike the current study. In the study conducted by Afacan (2008: 174) there was a significant relationship between the level of perception of the primary school students about their STCE relationship and their scientific attitudes. Çelik and Onay (2014: 48) examined the relationship between the scientific attitudes and self-confidence of the 6th class students. In this study, a positive relationship was found between students' self-esteem and scientific attitude levels. He stated that students with high self-confidence levels had high scientific attitudes. In the study investigated by Özden (2012) it was appeared that there was a positive and significant relationship between the views of primary school students towards scientific knowledge and their scientific attitudes. In the study conducted by Ergin and Özgürol (2011), it was obtained that there was a positive and significant relationship between students' emotional intelligence and scientific attitudes. In the study conducted by Kılıç (2011), it was determined that the relationship between scientific creativity and scientific attitude was

not significant. In the study conducted by Gözcü Reyhan (2018), it was clear that there was no significant relationship between students' perceptions of problem solving and their academic success.

According to the results of this study, it was concluded that the scientific attitudes of female students with the high problem-solving skills were low. It was found that the relationship between male students' problem-solving skills and scientific attitudes was not significant. Ergin and Özgürol (2011: 1772) found that scientific attitude did not differ by students' age, gender and class level. Mıhladız and Duran (2010), Demirbaş and Yağbasan (2011: 338), Özden (2012: 95) and Özden and Yenice (2014) also found in their studies that there was no significant relationship between students' scientific attitudes and gender. In the study carried out by Terzi (2003: 10) on 6th class students' interpersonal problem-solving skill perceptions and the study conducted by Taylan (1990: 50), it was found that there was no significant difference in terms of gender variable.

According to the findings of the study, no significant relationship was found between the problem-solving skills and scientific attitudes of secondary school students in terms of the class level variable. According to this result, the relationship between students' problem-solving skills and scientific attitudes does not change as to the class level. Similarly, in the studies investigated by Afacan (2008) and Özden (2012), it was determined that the scientific attitudes of the students did not differ by the class level. In the study conducted by Gömleksiz and Bozpolat (2012), it was resulted that there was no significant difference between the 4th and 5th class students in terms of problem-solving skill levels. Akyol (2019) found in his study with students of education faculty that there was no significant difference between problem-solving skills and class level.

As a result of the analysis, as to the education level of the mother and father, there was no significant relationship between secondary school students' problem-solving skills and scientific attitudes. However, a negative and low-level relationship was found in terms of students whose father was a primary school graduate. Similar results were found in the literature review. Mıhladız and Duran (2010) concluded that there was no significant correlation between the attitudes of primary students towards science and the educational level of their parents. In the study investigated by Derin (2006), it was concluded that there was no significant relationship between the problem-solving skills of the 8th class students and the education level of their parents.

According to the results of this study, the common effect of problem-solving skills and gender on the scientific attitudes of secondary school students was not significant. Hence, it can be said that students' problem-solving skill levels or the difference in gender do not influence their scientific attitude level. These findings are similar to the results of the study conducted by Fadli (2019) on scientific attitudes and problem-solving skills.

The common effect of problem-solving skills and class level on the scientific attitudes of secondary school students was investigated. It was concluded that the common effect was not significant. As to the analysis, when the scientific attitudes of the secondary school students were examined according to their problem-solving skill levels, no significant difference was obtained. It was determined that students' problem-solving skills were not a significant predictor of their scientific attitudes. In another saying, problem solving skills do not have an impact on the explanation of students' scientific attitudes.

This study was conducted with secondary school students. A similar study can be carried out at primary school, high school, and university level. The study was designed with quantitative research method. It can be performed by patterning with qualitative research methods to obtain more detailed information. The scope of the research can be expanded by measuring attitudes towards disciplines such as mathematics. To have more detailed information in determining problem solving skills, a measurement tool can be developed and examined in terms of different variables. The results can be compared by conducting a study in terms of scientific attitude on a group trained in problem solving skills. The variables subject to the research can be considered together in an experimental study. By conducting a meta-analysis study within the scope of the variables subject to the study, the results obtained with a holistic perspective can be reinterpreted.

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International Journal of Contemporary Educational Research (IJCER)

www.ijcer.net

Developing a Story Writing Attitude Scale for Secondary School Students

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To cite this article:

Ertan Özen, N., & Duran, E. (2021). Developing a story writing attitude scale for secondary school students. *International Journal of Contemporary Educational Research, 8*(1), 84-93. DOI: https://doi.org/10.33200/ijcer.788115

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International Journal of Contemporary Educational Research
Volume 8, Number 1, March 2021, 84-93 ISSN: 2148-3868

Developing a Story Writing Attitude Scale for Secondary School Students*

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Abstract

The aim of this study is to develop a measurement tool to measure the attitude towards story writing. Validity and reliability studies of the scale, applied to 243 secondary school students, were carried out with exploratory factor analysis, measurement of internal consistency and confirmatory factor analysis. EFA revealed that the scale had three dimensions as planned in the original. Cronbach Alpha internal consistency coefficient was calculated as 0.95 in order to determine the reliability of the scale. Kaiser-Meyer-Olkin (KMO) coefficient was found as 0.94 in principal component analysis. In addition, the Barlett Sphericity test was significant ($\chi 2$ = 3529,500; p<0,01). Factor loads as a result of varimax rotation varies between 0.43 and 0.80. In CFA, it was stated that the standardized regression coefficients varied between 0.51 and 0.81, and that the items in each dimension had a significant predictive power. As a result of the analysis, a valid and reliable scale was obtained. In addition, the attitudes of 243 secondary school students towards story writing were investigated. As a result of the data, it was observed that students had a positive attitude towards story writing.

Key words: Attitude, Writing story, Scale development

Introduction

The student who is capable of writing establishes a connection between thoughts and what he / she has learned, and transfers his / her knowledge. Developing a positive attitude towards writing skills enables students to be successful not only in Turkish classes, but also in many different classes. With the development of written expression skills, students have sensitivity to aesthetics of their writings. The higher the student's attitude towards writing, the higher the quality of his writing will be.

The most important type of writing used in the development of writing skills in schools is stories. Stories are aesthetic texts that enrich our lives and our imagination. In particular, it is important for teachers to use different methods, techniques and practices that will give students an interest in writing in order to develop a positive attitude towards writing. Developing a positive attitude towards writing will also have a positive impact on the attitude towards writing a story.

Writing, which is one of the important areas in language development, is the expression of emotions, thoughts and wishes in our minds by various symbols in accordance with certain rules (Güneş, 2013). Writing skill is a narration skill which develops after listening, speaking and reading skills. Writing involves a number of challenging tasks, such as combining and using words correctly, following grammatical rules, maintaining unity and consistency (Del Aguila, 2016). Other than helping us improve our writing style, writing has virtues such as communicating with others and most importantly expressing thoughts (Krashen, 1993; Smith, 1988; cited in: Krashen, 1993). People have contributed to civilization by providing information and culture transmission through writing (Coşkun, 2007).

The texts that began with oral tradition and became written in the history of almost every nation are examples of the type of story. Turkish storytelling began to appear in our literature especially with the works of the period of

* This article is derived from the first author's PhD dissertation entitled "Contribution of digital storytelling to 7th Grade students' creative thinking skills", conducted under the supervision of the second author.

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Tanzimat. Before this period, there were mostly folk tales, legends, narratives taken from the Qur'an, and Tales of Dede Korkut (Eronat, 1995). Stories are short texts about events that have been experienced or that are possible to be experienced in an enjoyable way (Kayasandık, 2012). The story is usually a chronological narrative involving the basic characteristics of an event, which is transmitted through some channels over time (Genette, 1982; Abbott, 2010). According to Boratav (2009), the first type of text to show the child his mother tongue consistency, richness and subtlety are stories. Students can write events or fictional events related to their own lives applying to their imagination even if they are not literary (Arı, 2008).

Teachers should encourage students to write stories for reasons such as having fun, developing artistic expression, exploring the function and value of writing, revealing creativity, explaining their thoughts clearly, finding their identity, learning to read and write (Tompkins, 1982). Students who have difficulty in writing stories often do not have knowledge about the writing process, they have difficulties in producing ideas, they do not plan well, they do not use strategies to produce and organize text, they have difficulty in writing mechanics and they do not review or review very little what they write (Englert, Raphael, Fear & Anderson, 1988; Graham, Harris, MacArthur & Schwartz, 1991).

Writing practices in schools are carried out in a traditional structure. For this reason, writing is not regarded as an attractive activity by children. During the applications, rules such as paper cleaning, writing properly, compliance with grammar rules are more important than necessary. Thus, children direct attention to the form rather than the content of the article (Oral, 2003). Developments of children's imagination and creativity are ignored. The student, who is overwhelmed by boring and meaningless rules, avoids the work of writing.

Today, researchers view attitudes as evaluable judgements (Fazio & Olson, 2003; Schwarz, 2007). Attitude is defined as a positive or negative intensity ranking and rating directed towards a psychological object (Thurstone 1928; Sherif & Sherif, 1996). Most students tend to show negative attitudes towards writing. Students fear making writing mistakes and they are not confident to exhibit their thoughts through writing (Jabali, 2018). The attitude towards writing is very effective in increasing the success of writing (Bartscher, Lawler, Ramirez & Schinault, 2001). Writing attitudes directly influence writing achievement and motivation (Graham, Berninger & Fan, 2007). Mason, Harris & Graham (2002) indicated that students had a positive attitude towards writing when they started to school, but towards the end of primary school this attitude worsened. So it is important for teachers to identfiy students' attitude toward writing and to do instructional practices of writing to develop it.

It is important to be able to see the students' attitudes towards story writing, to determine the methods and techniques used in the class, especially to shape their writing activities in this way. Therefore, it is important to do this study. The literature on attitude towards writing was reviewed and scales were found to measure attitude towards writing, not towards writing a story (Kırmızı, 2009; İşeri & Ünal, 2010; Erdoğan, 2012; Göçer, 2014; Akaydın & Kurnaz, 2015; Ayrancı & Temizyürek, 2017; Baştuğ & Keskin, 2017; Can & Topçuoğlu Ünal, 2017; Tavşanlı, Bilgin & Yıldırım, 2019). In addition, this study has importance for literature because of the lack of a scale of attitude in the field of writing stories.

Aim of the Study

The purpose of the study is to develop a scale to determine the attitudes of secondary school students towards writing stories.

Method

It is a scale development study to determine secondary school students' attitutes towards writing a story. In the first stage of the scale development study, "what is wanted to be measured" should be clearly determined. In the second stage, an item pool should be created. In the third stage, the format of the measurement tool should be decided. The other stages consist of reviewing the items by experts, ensuring item validity, applying the scale, evaluating the items, and finalizing the scale (Şahin & Boztunç Öztürk, 2018). In this study, necessary analyzes were made to determine the validity and reliability of the "Story Writing Attitude Scale for Secondary School Students".

Participants

The study group consists of 243 secondary school students who continue their education in Uşak. In scale development studies, it is recommended that the sample size for item analysis and factor analysis should be at least five times the number of the items (Bryman & Cramer, 2001). Therefore, the study group was aimed to reach at least five times the number of the items.

Scale Development Process

The aim of this study is to develop an attitude scale to determine the attitudes of secondary school students towards story writing. In this context, a literature review was conducted on writing, writing attitude, story, story writing and story writing attitude. Then, in accordance with expert opinions, nine questions were prepared as "Student Opinion Determination Form for Writing a Story" and 19 secondary school students' opinions were collected.

In accordance with the literature survey, students' and expert opinions, a measuring instrument consisting 37 items was created. In order to determine the comprehensibility and content validity of the scale, it was presented to 16 field experts and three Turkish teachers. In line with the feedback from the experts, two items were subtracted from the scale and arrangements were made. Prior to the validity and reliability analysis, 31 of the scale items contain positive expressions and four of them negative. The items in five-point likert type are graded as Strongly disagree (1), Disagree (2), Undecided (3), Agree (4), Strongly agree (5).

The developed form was applied to the study group and SPSS program was used for the statistical analysis. As a result of the validity and reliability analysis, it was decided to subtract seven items from the scale. Three of the seven removed substances are negative substances. As a result of the analysis, these substances have a negative factor load. As in the Benson & Hocevar (1985) study, it was concluded that the factor structures for positive and negative substances are different. It is stated by Marsh (1984) that there is a low likelihood that primary school children will show a positive concept of self when they do not participate in a negative statement. Schriesheim & Hill (1981) stated that negative expressions were less valid, and negative expressions led to errors in students' responses.

Data Analysis

In scale development studies, factor analysis is the most commonly used method to obtain data about the structure validity of a scale (Seçer, 2015). Generally, factor analysis technique is divided into two as exploratory factor analysis technique and confirmatory factor analysis technique. EFA was performed with the data obtained in the study. With this method, a smaller number of factors are described which explain the original variability of p number of variables, and factor loads, factor coefficients, and factor scores are calculated (Özdamar, 2002). In this context, the data obtained are listed in a table. Correlation matrix was used in descriptive factor analysis because the units and variance of the data were close to each other.

Kaiser-Meyer-Olkin (KMO) technique is used to comment on the adequacy of sample size in EFA (Seçer, 2015). This data obtained in the study is shown in a table. In addition, Barlett's Test of Sphericity was also given to determine whether the data came from a multivariate normal distribution.

The Cronbach Alpha coefficient is used to evaluate the accuracy of the responses to the items on the likert scale. In this context, the obtained Cronbach Alpha coefficient is shown in a table.

In this study, CFA was used to verify the structure determined by the EFA. To demonstrate the adequacy of the model, the fit indices are given in a table. In addition, the measurement model of CFA was given and the variables were commented.

Results

The findings of the study and the comments are explained under the related headings.

Development of Story Writing Attitude Scale for Secondary School Students

An exploratory factor analysis was performed for the first sub-objective of the study to develop a story writing attitude scale for secondary school students.

Findings Related to Exploratory Factor Analysis

The findings related to the adequacy of sample size in exploratory factor analysis are given in Table 1.

Table 1. KMO Coefficient for Factor Analysis of the Scale

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	Bartlett's Test of Sphericity Approx. Chi-Square	Df	Sig.
,94	3529,50	378	,00

In order to determine the factor structure of the developed scale, factor analysis was applied to the scores obtained from the responses of students to the scale. The KMO test is a criterion for testing the suitability of the data structure for factor analysis in terms of sample size (Çokluk, Şekercioğlu & Büyüköztürk, 2016). The KMO value has a value between 0 and 1. The following evaluation of levels for KMO values is that 0.50-0.60 is miserable, 0.60-0.70 is mediocre, 0.70-0.80 is middling, 0.80-0.90 is meritorious and over 0.90 is marvelous (Şencan, 2005). According to Pallant (2001), KMO value should be at least 0.60 and Kaiser (1974) stated that it should be at least 0.70. In the factor analysis of the study, KMO value was found 0.94 and it is significantly higher than acceptable value (0.70).

The suitability of the data for factor analysis can be examined by Barlett's sphericity test (Büyüköztürk, 2014). As a result of the analysis, the Barlett Sphericity Test was found to be significant ($\chi 2 = 3529{,}500$; $p<0{,}01$). The chi-square statistic shows that the data matrix is appropriate.

The construct validity of the scale was analyzed using the factor analysis on the data obtained from the developed scale and variance and factor eigenvalues of the scale items are shown in Table 2.

Table 2. Variance and Factor Eigenvalues of Story Writing Attitude Scale

Components	Eigenvalues	Variance Explained	Cumulative Variance
Component 1	12,269	22,985	22,985
Component 2	1,853	16,979	39,965
Component 3	1,634	16,306	56,271

In social sciences, scale items are expected to explain the total variance between 40% and 60% (Can, 2014). It can be seen that the scale has a three factor structure because the dimension where the total variance is explained over 40% is the third factor and the substance is collected under three factors whose eigenvalue is greater than 1.

It was observed that the scale has three components as in the original and these three eigenvalues were over 1.00. These three sub-components accounted for 56.27% of total variance.

Factor load values are shown in Table 3 in order to see the relationship of substances with factors.

Table 3. Factor Load Values of Story Writing Attitude Scale

Items	Component 1	Component 2	Component 3
Love8	,80		
Love7	,78		
Love1	,73		
Love3	,69		
Love9	,68		

Love14	,68		
Love5	,67		
Love13	,59		
Love11	,53		
Love6	,50		
Love4	,43		
Benefit2		,77	
Benefit8		,75	
Benefit7		,74	
Benefit10		,71	
Benefit5		,65	
Benefit1		,64	
Benefit9		,54	
Benefit4		,54	
Learning Environment4			,70
Learning Environment11			,69
Learning Environment10			,68
Learning Environment3			,62
Learning Environment9			,62
Learning Environment2			,59
Learning Environment8			,56
Learning Environment5			,52
Learning Environment1			,50

Varimax rotation was applied to the data in order to see the factor load distribution. Items loading 0.30 indicates that 9% of the variance explained by the factor. The variance at this level is remarkable and the load value of 0.60 and above is high, the load value between 0.30 and 0.59 can be defined as medium regardless of its mark and this is taken into consideration in variable extraction (Büyüköztürk, 2002).

As a result of the analysis, 2, 10 and 12, which are the items of love dimension in the original scale, items 3 and 6 in the benefit dimension and items 6 and 7 in learning environment were found in more than one dimension or not in any dimension and were removed from the scale. After removing these substances from the analysis, factor analysis was performed for the second time and the results indicated in Table 3 were obtained. When these results were examined, as in the original measurement tool, the items had high values under three factors. It was determined that the first factor of the scale consists of 11 items, the second factor consists of 8 items and the third factor consists of 9 items. Factor load values of the first factor ranged between 0.43-0.80, the factor load values in the second factor ranged between 0.54-0.77 and the factor loads in the third factor ranged between 0.50-0.70.

Reliability Analysis

In this study, Cronbach Alpha method, which is one of the methods of determining reliability in measurement tools, was selected and the calculated value is shown in Table 4.

Table 4. Cronbach Alpha Internal Consistency Coefficient of Story Writing Attitude Scale

Component	**Number of Items**	**Cronbach's Alpha**
Component 1	11	.91
Component 2	8	.90
Component 3	9	.86
Total	28	.95

The success in predicting the behavior of individuals depends largely on the reliability of the test and the scores obtained from the test (Büyüköztürk, 2014). Cronbach Alpha coefficient is calculated for the rated attitude and personality tests (Can, 2014; Thorndike & Thorndike, 2018). In the literature, it is stated that if Cronbach alpha coefficient of the scale is between 0.80 and 1, the scale is highly reliable; if it is between 0.60 and 0.79, the scale is reliable; if it is between 0.40 and 0.60, the scale is low reliable and if it is between 0 and 0.39, the scale is unreliable (Büyüköztürk, 2014). For the sub-dimensions of the scale, Cronbach Alpha coefficients were 0.91; 0.90; 0.86, while it was 0.95 for the whole scale. These values showed that all of the sub-dimensions and the whole scale were reliable.

Findings Related to Confirmatory Factor Analysis

CFA was used to test the construct validity of the scale. The model fit indices of the measurement tool are given in Table 5.

Table 5. Comparison of Measurement Values and Reference Adaptation Index Values in the Study

	Measurement Values Before Modification	**Measurement Values After Modification**	**Perfect Fit**	**Acceptable Fit**	**Fit**
CMIN/ sd	1,80	1,57	0≤χ2 /df≤2	2≤χ2 /df≤3	Good fit
p		,00	.05>		Not fit
GFI	,84	,86	0,95≤GFI≤1,00	0,90≤GFI≤0,95	Acceptable
AGFI	,81	,84	0,90≤AGFI≤1,00	0,85≤AGFI≤0,90	Acceptable
IFI	,92	,94	0,95≤GFI≤1,00	0,90≤GFI≤0,95	Acceptable
CFI	,91	,94	0,97≤CFI≤1,00	0,95≤ CFI ≤0,97	Acceptable
RMSEA	,05	,04	0≤RMSEA≤0,05	0,05≤RMSEA≤0,08	Perfect fit

Reference: Blunch, 2008; Byrne, 2010

Many conformity index values should be used in order to more accurately determine the compatibility of the model due to the fact that the fit indices have strengths and weaknesses compared to each other in evaluating the harmony between the theoretical model and the actual data (Büyüköztürk, Akgün, Kahveci, Demirel, 2004). Chi-Square Goodness of Fit, Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), Incremental Fit Index (IFI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA) indexes are used in this study.

The ratio of the χ2 /df, the overall compatibility index of the model tested, is in marvelous fit range. On the other hand, the p value considered as a reference for the acceptance of the general compliance index in the model should not be significant and χ2 / sd should be less than 3 (Schumacher & Lomax, 2010). However, it is stated that if the ratio of χ2/df is acceptable, it is enough for the general fit index of a model to be compatible (Meydan & Şeşen, 2011).

In addition, other conformity indexes such as GFI, AGFI, IFI and CFI are also stated as acceptable as they approach 1 (Blunch, 2008; Bryne, 2010). The GFI value (0.86), the AGFI value (0.84), the IFI value (0.94), the CFI value (0.94) showed acceptable compliance. On the other hand, it can be said that the value of RMSEA (0.58) is acceptable within the framework of the reference values accepted (Arbuckle, 2012).

The diagram of the model that reflects the dimensions of the scale, the items which the dimensions have and the standardized regression weights in the analysis of each item is as follows.

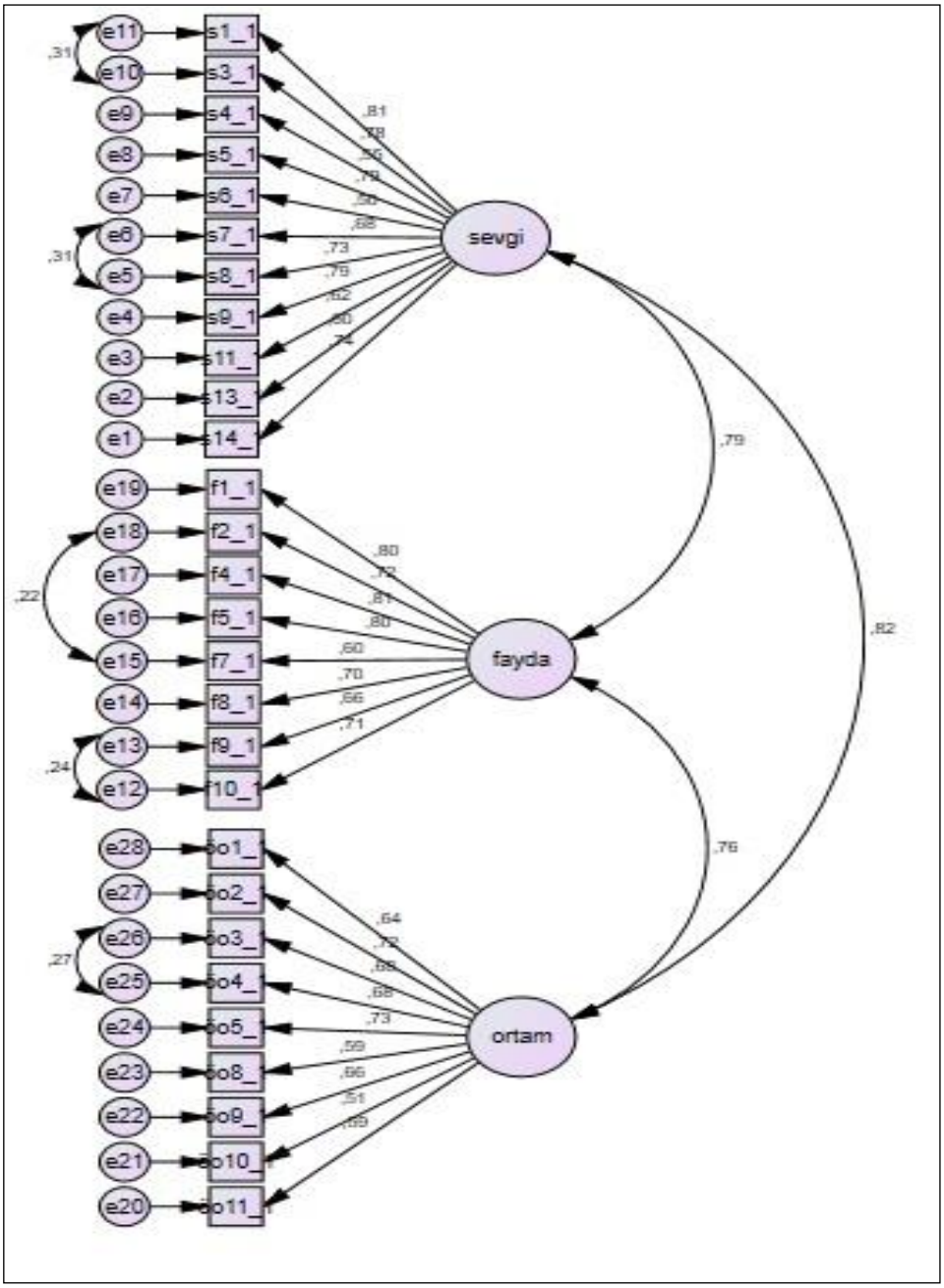

Diagram 1. Story Writing Attitude Scale Confirmatory Factor Analysis Results

Regression values show the power of estimating hidden variables of observed variables, in other words factor loads (Yemez, 2016). Factor loads ranged from 0.51 to 0.81 for *the love* sub-dimension, from 0.60 to 0.81 for *the benefit* sub-dimension, and from 0.51 to 0.73 for *the learning environment* sub-dimension. These findings explain that the items in each dimension have considerable predictability. Factor loadings were found to be significant and the items were loaded correctly.

In the path diagram, all the standardised values obtained should not exceed 1 (Aytaç & Öngen, 2012). 0.79, 0.82, 0.76 values show standardized correlation between love, benefit and learning environment. When we look at the path diagram, one-way arrows pointing towards the observed variable from the love, benefit and learning environment shows one-way linear relationship. Thus, it is seen how well each item represents its own hidden variable.

When the standardized parameter values are considered, the most affecting item of dimension love is the first item with a load of 0.81 and the least affecting is the items 6 and 13 with a load of 0.50. The most affecting item of dimension benefit is the forth item with a load of 0.81 and the least affecting is the seventh item with a load of 0.60. The most affecting item of dimension learning environment is the fifth item with a load of 0.73 and the least affecting is the tenth item with a load of 0.51.

Conclusion and Discussion

In this study, a 28-item Story Writing Attitude Scale was developed to determine attitudes of secondary school students towards story writing skills. Harmer (2004) emphasizes that being able to write is a vital skill for everyone using their own first language. Writing triggers thinking, enables learners to concentrate and organize their ideas, and increases their ability to summarize, analyze, and criticize (Rao, 2007). The writing attitude is highly effective on improving or hindering writing achievement (Bartscher, Lawler, Ramirez & Schinault, 2001). Learners with positive attitudes performes significantly better than those with negative attitudes on writing tasks (Sarkhoush, 2013). The increase in writing activities has presented teachers with the challenge of determining their students' attitudes toward writing because of the link between motivation and literacy learning (Turner & Paris, 1995). So, our purpose was to develop an instrument that teachers and researchers could use to learn about students' attitudes toward writing stories.

According to the analysis results, the KMO value was found to be 0.94 in factor analysis. As a result of the analysis, the Barlett Sphericity test was found to be meaningful. After vertical rotation of varimax factor load values were found to be between 0.43 and 0.80. Calculated internal consistency reliability coefficient was found to be 0.95 for the whole scale. In the CFA, it was observed that the general fit index of the model, $\chi 2$ /df, was within the marvelous fit range, and the items in each dimension had a significant predictive power. The findings show that the story-writing attitude scale is a valid and reliable measurement tool that can measure students ' attitudes towards story-writing skills.

In our literature, Akaydın & Kurnaz (2015) developed a writing attitude scale for high school students. Ayrancı & Temizyürek (2017) conducted a scale development study on the free writing attitudes of the students of the Faculty of Education. Kırmızı (2009), developed a Scale of Attitude Towards Writing for 4^{th} and 5^{th} grade students. The Attitude Scale for Written Expression was developed by Ak (2011). Temizkan & Sallabaş (2009) developed Attitude Scale for Reading and Writing to determine the attitudes of university students towards reading and writing activities. Can (2018) developed Writing Attitude Scale for Secondary School Students. The study of adaptation of the Writing Attitude Scale, developed abroad, to Turkish language was carried out by Göçer (2014). In the same way, studies were carried out by Can (2016) and Yıldız & Kaman (2016).

Teachers, the most important element of the education system, have a great influence on strengthening students' writing skills and making them enjoy writing. In particular, teachers' personal attitudes were found to affect the time spent teaching writing, the quality of teaching writing and the selection of teaching strategies (Bandura & Schunk, 1981; Robinson & Adkins, 2002; Street, 2003). Therefore, at every stage of the acquisition of writing skills, by monitoring, guiding the students, the teacher can help the students develop positive attitudes towards writing not only as a guide but also as a participant. The importance of the attitude of the students towards writing is closely related to the effective realization of the skills in Turkish Teaching Program such as short text writing and story writing.

In order to help teachers examine their students' attitudes toward writing stories, it is critical for the field of writing to have a reliable and valid method in which to measure attitudes of students. We can say that the Story Writing Attitude Scale for Secondary School Students developed to address a significant deficiency in the field of writing is a valid and reliable measurement tool. We believe that it can be a source for researchers working in this field. In addition, we expect teachers to benefit from this measurement tool.

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International Journal of Contemporary Educational Research (IJCER)

www.ijcer.net

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To cite this article:

Öngören, S. (2021). The pandemic period and the parent-child relationship. *International Journal of Contemporary Educational Research, 8*(1), 94-110. DOI: https://doi.org/10.33200/ijcer.800990

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International Journal of Contemporary Educational Research
Volume 8, Number 1, March 2021, 94-110 ISSN: 2148-3868

The Pandemic Period and the Parent-Child Relationship

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Abstract

The aim of this study is to investigate parents' relationships with their children during the pandemic period. The study is a qualitative research study and was conducted with a case study design. The study group of this research consisted of 19 parents. The study group was selected using the criterion sampling method of purposive sampling. The criteria specified in this research were that parents should have a child attending preschool and at least a secondary school level of education. The research data were gathered during the 2019-2020 academic year via interviews conducted with parents having at least one child who was still receiving preschool education, using a semi-structured interview form. The study variables were age, occupation, education level, number of children, and cohabitation status of the parents. The data obtained from the interviews were analysed using the content analysis method. Accordingly, the researcher aimed to assess, through content analysis, the reasons for directly unobservable or non-quantifiable behaviours of the parents by conducting interviews. The research findings revealed that the positive aspects of the parent-child relationship during the pandemic were stated to be spending time together, sharing, doing activities, and communication, while the negative aspects were reported as social isolation, domestic conflicts, and mobile phone addiction. Changes in the mother-child relationship during the pandemic were revealed to be related to knowing each other, spending time together, conflicts, and obeying rules, while in terms of the father-child relationship, changes were seen in communication, doing activities and sense of responsibility. While participants evaluated domestic relationships positively with regard to being together, being supportive and positive communication, they regarded them negatively in terms of conflicts, communication problems and boredom. Lastly, participants stated that educational activities, playing games, watching educational videos and preparing food were the activities on which the most time was spent.

Key words: Pandemic, Family, Mother, Father, Child, Relationship

Introduction

Virus mutations that can be seen in every period in human history cause major disasters such as pandemics affecting humans and animals. Due to the COVID-19 disease, which appeared in the world towards the end of 2019 and was declared as a pandemic by the World Health Organisation (2020), radical changes have occurred in the lifestyles and habits of individuals and societies. In line with the decisions taken in the pandemic period, measures such as lockdowns, quarantine, social distancing, travel restrictions, closures of institutions and workplaces, flexibility in working hours, implementation of homeworking and conducting the education process online (Üstün & Özçiftçi, 2020) have been included in the new social order. In these new living arrangements, people's lives have been affected in different ways in a physical, psychological, social and economic sense. Families, which make up the smallest units of society, have had their share of these changes. During this period, when there is limited contact with the outside world, many families, who have found themselves imprisoned in their own homes, have faced negative situations such as domestic violence, depression and anxiety (Campbell, 2020). Due to changes occurring in their working lives, while some parents have left work, others have switched to the system of working part time or working from home, and the periods of isolation and time spent at home have increased. In this period, it is seen that mothers' transfer of their working lives to the home environment has caused an increase in their responsibilities related to care and education of their children, and a large increase in their household chores (Akbaş-Zeybekoğlu & Dursun, 2020). Moreover, as a result of the temporary closure of education institutions, the distance learning process has begun, and educational activities are carried out at home under the responsibility of families. These changes have altered the family lifestyle (Yıldız, 2020),

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and with regard to both parents and their children, it has become more difficult to maintain a balanced and sustainable lifestyle.

In times of pandemic, when new lifestyles emerge, families' physical and psychological welfare can be negatively affected. Factors such as family members spending more time together, limitation of open-air activities, disruption of nutrition, sleep and living habits, decrease in interpersonal relationships, existence of negative news about the epidemic, lack of information, and fear of catching the disease or losing loved ones, may hinder the healthy continuation of relationships within the family (Brooks et al.,2020). Pandemic periods create short- and long-term effects on children's physical, social and emotional development (Schonfeld & Demaria, 2015). Although the medical literature (Goldman et al., 2020; Lee, Hu, Chen, Huang & Hsueh, 2020) reveals that children are physically susceptible to the COVID-19 virus at only a limited level, children are mostly exposed to the psychological effects of the pandemic. As a result of the disruption in the normal lifestyle due to school closures, lack of open-air activities, and abnormal nutrition and sleep habits, problems like monotony, unhappiness, impatience, irritability and various neuropsychiatric symptoms may appear (Ghosh, Dubey, Chatterjee & Dubey, 2020**)**. Children whose daily routines are altered continue to be psychologically negatively affected due to uncertainty experienced along with high levels of parental stress, fears, and physical and social isolation (Imran, Zeshan & Pervaiz, 2020**)**. Similar findings were made in studies conducted regarding this process, and various negative situations were revealed in children in the pandemic period such as sleep problems, depression, addiction to technological tools, and increase in parental stress towards children (Jiao et al., 2020; Lee & Ward, 2020; Usta-Yüksek & Gökcan, 2020; Xie et al., 2020). On the other hand, studies can also be found which support the idea that relationships between parents and children have developed and that family ties have been strengthened during the pandemic period (Ragamayi, 2020). This process affects children and other family members in different ways.

Within the family in which they grow up, children become members of societies in which a certain language is spoken, and they are interconnected by religious, economic and cultural ties. According to Bronfenbrenner's (1989) bioecological model of human development, every person develops inside a microsystem within a mesosystem embedded in an exosystem. When considered in terms of the child, relationships and actions with the family, teacher, school and friends are included in the microsystem. In this system, interaction and relations between individuals are reciprocal and affect one another. In other words, the family has an impact on the child, and vice versa (Bronfenbrenner & Morris, 2006; Woolfolk-Hoy, 2010). The special bonds that are formed as a result of interaction between the family and child last for a lifetime, and these ties form the basis of other relationship models. People of all ages are in need of the family for information, assistance and pleasant interaction. The family is a whole unit and has a mechanism with which members monitor each other and are affected by each other. Relations within the family are a continuous, variable and dynamic process that is affected by the approaches that family members have towards each other and by the communication that they have with each other. Communication within the family and the way in which parents bring up their children also have an impact on parent-child relationships (Beck & Ledbetter, 2013; Delvecchio, Raspa, Germani, Lis & Mazzeschi, 2020; McCubbin & Figley, 2014; Tavassolie, Dudding, Madigan, Thorvardarson & Winsler, 2016). Considered from this point of view, the strength of family members' relationships will affect the health and quality of the family. While warm and strong family ties have a positive effect on physical and psychological health, negative situations lead to developmental problems (Deković & Buist, 2005; Kelifa, Yang, Carly, Bo & Wang, 2020). Intra-family relationships have a complex effect on the child's development, and Bronfenbrenner (1992) names this situation as the "effect of third parties". Third parties may support development or offer inhibitory contributions. For example, sensitive mothers and fathers who have achieved marital adjustment will support each other's behaviours as parents. These parents are warmer, more encouraging and more rewarding. In the exact opposite case, however, parents who punish their children, show less response to their needs and criticise them more, are also encountered. Serious emotional problems may appear in these children. Couples who cannot adapt to relations within the family due to parental conflicts have difficulty in establishing effective communication with their children (Caldera & Lindsey, 2006; Hughes, Devine, Mesman & Blair, 2020). According to Epstein, Baldwin & Bishop's (1983) McMaster Model, the characteristics of a healthy family whose intra-family relations are strong were determined as problem-solving, communication in the family, distribution of roles, affective involvement and responsiveness, and behaviour control. Healthy interaction performed in a healthy family strengthens the bonds among family members. The constructive solution of problems that occur in the family by using the correct channels of communication, and by emotional responses given sincerely by family members to one another, are very important for healthy parent-child relationships.

Family relationships are defined as the interaction between family members within the framework of certain rules. Family relationships change according to the birth of a child. In other words, relationships within the family are shaped by parents' interactions with their children. Due to differences in methods of raising children,

parents choose different ways of interacting with their children (communication, response to crying, education, etc.), but parents' ways of communicating with their children are universal (Becvar & Becvar, 2017; Trawick-Smith, 2014). As individuals, too, mothers and fathers differ from each other in the way they communicate with their children. With regard to the mother-child relationship, Adler stated that relationships within the family were very important for determining an individual's personal characteristics, and that the individual's socio-biological development was entrusted to the mothers (Adler, 2005). According to Freud, the mother is the person for whom the child establishes the first, unique and most powerful affection, which remains constant throughout his/her life (Ainsworth, 1989). Erikson stated that the mother-baby relationship, which is established during the first two years after birth, is very important for forming a sense of security or insecurity in the infant. The quality of interaction between the mother and child in this period forms the basis of development as healthy individuals in an emotional sense (Gander & Gardiner, 2001). In father-child interaction, however, although cultural differences are in evidence, it can be said that fathers are less involved in the care of children, that as well as physical games, they fulfil responsibilities such as feeding and giving baths, and that fathers who are supported by their wives take more responsibility in areas related to their children (Bouchard, Lee, Asgary & Pelletier, 2007; Kuo, Volling & Gonzalez, 2018). Although parental roles and interactions vary according to the social and cultural structure, the positive relations require parents to take the necessary responsibilities and cooperate together (Feinberg, 2003). Consequently, in healthy families in which intra-family relationships are strong, parent-child interaction is reciprocal and in these families, quality care is provided for the children. Quality care of children can be listed as providing them with a safe environment, giving them access to games materials appropriate for their ages, and offering them opportunities to take part in suitable activities (Santrock, 2011). According to the UNESCO (2020) data, during the pandemic period, an estimated 1.38 million children have been unable to go to school, and have had no access to different activities, team sports or games areas. It is certain that in long periods of lockdown, when parents try to keep their children busy and safe at home, parents who manage home environments are in more need of new skills such as offering their children quality care (Szabo, Richling, Embry, Biglan, & Wilson, 2020). For this reason, in order to strengthen parent-child relationships, it is very important to convert this long period spent stuck at home into an opportunity and to provide support for parents and children.

In recent years, the relationship between the parent and child has been discussed in the framework of a two-way interaction in which the child and parent affect each other reciprocally. The basis of the relationship between the parent and child is formed by attachment defined as an emotional bond established between the child and the person providing the child with primary care (Cummings, Braungart-Rieker & Du Rocher-Schudlich, 2003; Kochanska, Boldt & Goffin, 2019). Bowlby (1988) argued that in attachment theory, the emotional bond established between the mother and child in the period after birth represents the attachment process that continues throughout life, and that it has a function in determining an individual's relationships with other individuals. Zeanah et al. (1994) stated that the style of relationship between the mother and baby determines the quality of the bonding relationship between the mother and baby. In addition to attachment, the parent's childrearing attitudes and behaviours, and the effects of these on the child, are also very important for the parent-child relationship. Baumrind (1971) explained parenting styles as authoritarian, authoritative and permissive. Based on Baumrind's classification, Maccoby and Martin (1983) discussed "permissive parenting" in two different categories, namely, "permissive/indulgent" and "permissive/neglectful". Hetherington and Clingempeel (1992) studied the parent-child relationship on the basis of positivity and negativity, and evaluated a positive parent-child relationship as the extent to which the parent is sensitive, concerned and warm towards the child, the degree to which he/she establishes good communication with the child, and the extent to which he/she is happy to be the child's parent. A negative parent-child relationship is revealed to be conflict in the relationship with the child, and negative emotions, and high levels of punishment. When the research findings related to the parent-child relationship are examined, it is seen that a positive parent-child relationship supports the child's development positively (Dereli & Dereli, 2017; Mahoney & Bella, 1998) and affects shaping the child's personality and the future adult life (Bernet, Wamboldt & Narrow, 2016; Kennison & Spooner, 2020; Orth, 2018; Vasilyeva & Shcherbakov, 2016).

It is seen that the studies conducted on the parent-child relationship in Turkey are generally related to parental attitudes and are discussed in the context of parental attitudes rather than parenting styles. When the studies on parent-child relationship in early childhood are examined, it has been revealed that the parent-child relationship differs according to various variables related to mother and father (age, education level, employment status, etc.) (Cantekin & Akduman, 2020; Sweeney & MacBeth 2016; Uzun & Baran, 2019) and that family education programmes are effective in developing the parent-child relationship (Erdoğan & Zelyurt, 2016; Feinberg, Jones, Kan & Goslin, 2010; Saygı & Balat 2013; Zorbaz, 2018). In this context, this research was conducted due to the fact that there is a lack of early childhood studies based directly on the positive parent-child relationship and the negative parent-child relationship, and at the same time, the fact that there are few studies in the

literature examining relationships within the family during the pandemic period (Amakiri et al., 2020; Başaran & Aksoy, 2020; Di Giorgio, Di Riso, Mioni & Cellini, 2020; Lee & Ward, 2020). When the research findings are examined, it is revealed that both positive and negative family experiences have occurred in the pandemic period, and that this period has had psychological effects on families. It is considered that discussion, from different aspects, of parent-child relationships that have undergone changes during the period of the pandemic, which has resulted in big changes (working from home, isolation et al.) in the lives of family members and altered habits and lifestyles, is important in terms of both families and children, and will serve as a guide for intervention studies that are conducted on this subject in the future. In this difficult period, supporting and improving the positive aspects of the parent-child relationship by reducing its negative aspects will contribute to strengthening the relationship between parents and children and in this way, to maintaining the existence of healthy families.

Accordingly, the sub-aims of this study, which aims to examine the parent-child relationship during the pandemic period, are to reveal, according to the views of parents:
1. What are the effects of the pandemic period, when family members remain at home for long periods, on parents' relationships with their children of preschool age?
2. What are the changes occurring in mother-child relationships during the pandemic period?
3. What are the changes occurring in father-child relationships during the pandemic period?
4. What are the changes in relationships within the family during the pandemic period?
5. What are the activities carried out by parents together with their children with the aim of strengthening parent-child relationships in the pandemic period?

Method

The method section of the study includes the headings of research model, study group, data collection tool and data collection, data analysis, and validity-reliability.

Research Model

The aim of this study is to investigate parents' relationships with their children during the pandemic period. The research is a qualitative study and was conducted with a case study design. Qualitative research enables researchers to define the world in which people live, the experiences that they have, and the meanings assigned to these experiences (Glesne, 2016). A case study is a qualitative investigation made in cases where a current phenomenon occurs and where differences between the phenomenon and context are not distinct (Yin, 2015). In this context, an attempt is made in this study to investigate the current state of the relationship between families and their children during the pandemic period, using a qualitative research method and a case study design.

Study Group

The study group of this research consists of 19 parents who were determined by criterion sampling method, which is one of the purposeful sampling methods. A purposive sampling method utilises a sample that is appropriate and necessary for the aim of the research within the scope of the study (Fraenkel, Wallen & Hyun, 2012). Criterion sampling is the determining of certain criteria suitable for the aim of the research, and the forming of the sample from these criteria (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz & Demirel, 2015). The criteria specified in this research were that parents should have a child attending preschool and at least a secondary school level of education. In the study, the variables were determined as age, occupation, education level, number of children and cohabitation status of the parents. A total of 19 participants were included in the study, and according to the age variable, 2 participants were aged 26-31, 9 participants were aged 32-37, and 8 participants were aged 38 and over. Among the participants, in terms of occupation, there were 8 housewives, 9 teachers, 1 civil servant and 1 tradesman. With regard to education level, 7 participants had completed secondary school, while 8 participants had bachelor's and 4 participants had postgraduate level education. Regarding the number of children, 9 participants had 2 children, 6 participants had 3 children and 4 participants had 1 child. Moreover, 1 participant was separated from her spouse, while 18 participants lived with their spouses.

Table 1. Demographic characteristics of participants

Participant code	Age	Occupation	Education level	Number of children	Cohabitation status
P-1	26-31	Housewife	Secondary school	2	Living together
P-2	38+	Housewife	Secondary school	3	Living together
P-3	38+	Housewife	Secondary school	3	Living together

P-4	32-37	Civil servant	Bachelor's	2	Living together
P-5	32-37	Housewife	Secondary school	2	Living together
P-6	26-31	Housewife	Secondary school	2	Living together
P-7	32-37	Tradesman	Secondary school	2	Living together
P-8	38+	Teacher	Bachelor's	1	Living together
P-9	32-37	Housewife	Bachelor's	1	Living together
P-10	32-37	Teacher	Postgraduate	1	Living together
P-11	32-37	Teacher	Postgraduate	3	Living together
P-12	38+	Housewife	Secondary school	3	Living together
P-13	32-37	Teacher	Bachelor's	2	Living together
P-14	38+	Teacher	Postgraduate	3	Living together
P-15	38+	Teacher	Postgraduate	2	Separated
P-16	38+	Housewife	Bachelor's	3	Living together
P-17	32-37	Teacher	Bachelor's	2	Living together
P-18	32-37	Teacher	Bachelor's	1	Living together
P-19	38+	Teacher	Bachelor's	2	Living together

Data Collection Tool and Data Collection

The data of this research were gathered during the 2019-2020 academic year through interviews with parents who had at least one child still attending preschool. The interview method is a process that is carried out with at least two participants and requires the gathering of detailed information about the subject (Yıldırım & Şimşek, 2011). A semi-structured interview form was used in the study. Accordingly, an attempt was made to access detailed information by addressing the interview questions and additional questions to the participants. In a semi-structured interview form, although the questions are prepared beforehand, additional questions are addressed to the participants during the interview process, which gives the researcher the opportunity to access more detailed information (Longhurst, 2010). The semi-structured interview form used in the research consists of two sections. In the first part of the research form, demographic information related to the participants' age, occupation, education level, number of children and cohabitation status is included. The second section of the research form contains five questions related to the aim of the research. Views on the draft interview form that was prepared were sought by sending it to 2 specialists in the field and 2 linguists, and according to these, a pilot interview was held with 3 participants. At the end of this process, the final revisions of the draft form were made, and the research was begun. Because of the pandemic period, the research data has been collected over a four-week period by using mass communication tools, and the participants took part voluntarily. Prior to commencement of the interviews, explanations related to the aim, scope and confidentiality of the research were given to the participants, and the interview questions were addressed to them. Each interview lasted an average of 15-25 minutes, and in cases where adequate responses were not received, more detailed responses were obtained by means of additional questions.

Data Analysis

The data obtained as a result of this study, which was conducted with the case study method of qualitative research, were analysed using the content analysis method. Content analysis is a method that makes it possible to examine, by way of communication, human behaviours that cannot be directly measured or observed (Fraenkel, Wallen & Hyun, 2012). Accordingly, the researcher aimed to assess, through content analysis, the reasons for directly unobservable or non-quantifiable behaviours of the parents by conducting interviews. The data obtained in the research were first converted into a computer environment and made ready for analysis. In the process of content analysis, data are analysed in the stages of (1) coding the data, (2) finding the themes, (3) organising the codes and themes, and (4) describing and interpreting the findings (Corbin & Strauss, 2015). The data obtained in this study were analysed using the NVivo 10 software program. At this stage, the codes and themes were specified and coding consistency was investigated by sending them to 2 specialists in the field. With this aim, the method specified by Miles and Huberman (1994) for assessing data consistency was used: P (percentage of agreement) = [Na (Number of Agreements)/ Na (Number of Agreements) + Nd (Number of Disagreements)] X 100. Examining the expert opinions, it can be said that a coding consistency rate of 90% was achieved, in other words, that the coding was done in accordance with the aim of the research. A high rate of consensus between coders in research indicates that the codings are reliable (Stemler, 2000).

Validity and Reliability

In research studies, while validity refers to the data collection tool, accuracy of the data, and stages of the research, reliability provides information about the consistency of the research. Information is given as to whether or not the research questions measure the topics intended, and the extent to which this is successful

(Creswell, 2014). To ensure validity and reliability in the study, plausibility, transferability, consistency and confirmability were taken into account. Accordingly, for plausibility in the study, a deeply-focused data collection technique was used, besides which, the participants' demographic information, the stages of the research, and the data collection tools are explained in detail (Creswell & Miller, 2000). To ensure transferability of the research, the data have been transferred without making revisions or interpretations. Furthermore, the planning of the research, the sample selection, the number of participants and the analyses are described in detail. To enable consistency of the study, the codes were sent to experts in the field and consistency with the researcher was calculated according to the formula for inter-rater consistency developed by Miles and Huberman (1994). Finally, to ensure confirmability in the research, the data were subjected to the views of the participants, who confirmed the statements that they had made. In addition, all information and documents, sound-recordings and notes collected during the research process were archived.

Findings

In this section of the study, information related to the findings is included. Within this scope, an attempt was made to reveal the positive and negative aspects of parent-child relationships during the pandemic period, to reveal the changes seen in mother-child relationships and father-child relationships, to make an evaluation of relationships within the family, and to find out which activities families spent time on during this period. The findings obtained as a result of the research are explained with diagrams.

1. Positive and negative aspects of parent-child relationships during the pandemic period

As the first problem question of the research, an attempt was made to reveal the positive and negative aspects of parent-child relationships during the pandemic period. Figure 1 below shows the positive aspects of parents' relationships with their children according to the views of the participants.

Positive Aspects

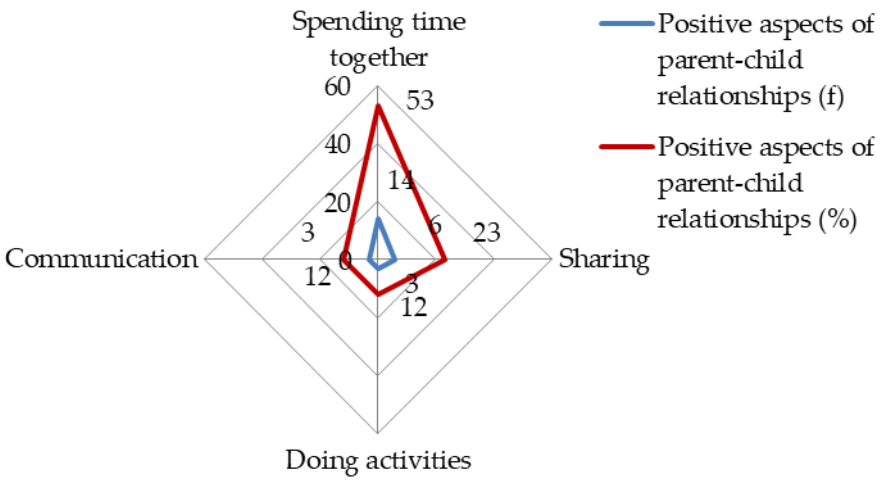

Figure 1. Positive aspects of parent-child relationships

Examination of Figure 1 reveals that the pandemic period had a positive effect on parent-child relationships in 4 subthemes. These were expressed as spending time together (53%), sharing (23%), doing activities (12%), and communication (12%), respectively. Positive views of participants related to these subthemes are given below.

"We had more time to spend time together. We spent this time very enjoyably. For the first time, we became so aware of being a family. We did a lot of activities, we played games, we watched films, and we cooked meals. All these activities showed us how valuable the time we spend together is." (P.3)

"We had the chance to spend more quality time with our child, to play games and do activities. We had the opportunity to do many activities that we hadn't been able to do before due to being busy with work and school time. Moreover, we began to help each other more as family members with housework (cleaning, tidying the bedrooms, setting and clearing the table, etc.). We chatted more and had the chance to develop our mutual relationships as parent and child." (P.10)

"We managed to play a great number of different games together, and in my opinion, our communication improved. We also had the chance to understand and get to know each other better. I saw that we could spend time together and that I could share things with my child." (P.19)

"It was positive in terms of the things we shared and the activities we did together. We spent the whole day together. Instead of doing nothing, we planned joint activities at all times of the day. Therefore, we saw that we always needed each other, and took pleasure in doing things together." (P.14)
When the positive findings related to the first research question are examined, it is seen that the majority of participants gave importance to spending time together and that they considered that this process contributed to their perception of the family. Furthermore, the participants were united in their view that sharing among family members increased, that time was set aside for joint activities, and that all of these improved communication within the family.

Negative Aspects

Figure 2 below shows the negative aspects of parents' relationships with their children in the opinions of the participants.

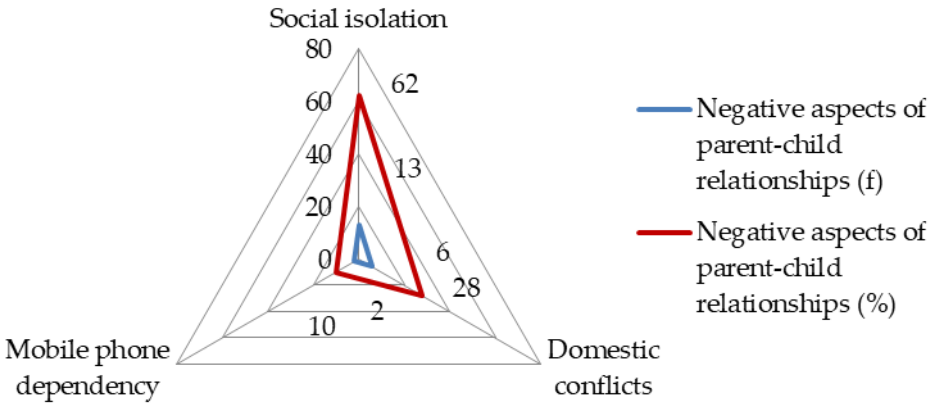

Figure 2. Negative aspects of parent-child relationships

Examination of Figure 2 reveals that the pandemic period had a negative effect on parent-child relationships in 3 subthemes. These were stated to be social isolation (62%), domestic conflicts (28%), and mobile phone dependency (10%), respectively. Negative views of participants regarding these subthemes are given below.
"This could have formed a habit that reached addiction level in him. I tried to keep him away from his phone and to do physical activities as much as possible. In this sense, this period could have been dangerous." (P.1)
"My child began to spend more time with technological tools that she had previously spent limited time with, and she began to grow less interested and more bored with the activities we did at home. Moreover, as a result of staying at home for long periods, more aggressive and bad-tempered reactions began to form in my child's behaviour than previously." (P.7)
"Since the children are unable to go out and socialise, the parents also become tense. Problems occur in social life and conflicts form within the family. This situation has an impact relationships and all members of the family are affected." (P.4)
"Since we were forced to spend time at home, we turned a blind eye to certain behaviours and allowed them. However, children do not know the limits of this. The pandemic period resulted in the relaxing of certain rules. The children thought that the rules were not important and that they could bend them." (P.11)
"Since we have only one child, she always wants to play with us. When the games are left to her, they take the form of chatting with her doll and this upsets us a little. After a time, we began to have difficulty finding different games for her that we could all enjoy together." (P.18)
Examination of the negative findings related to the first research question reveals that most of the participants emphasised their desire for socialisation and for this wish to be responded to. It can be said that for individuals who cannot meet their need for socialisation, conflicts are seen in the families they belong to. In this context, the importance of socialisation among basic human needs is also revealed. Furthermore, it can be said that children used mobile phones or other technological tools more often because the activities that families carried out with their children during the pandemic period were not sufficient.

2. Changes experienced in mother-child relationships during the pandemic period

The aim of the second problem question of the research was to reveal changes experienced in relationships between mothers and their children during the pandemic period. Changes that occurred in the mother-child relationship in the pandemic period according to the views of participants are shown in Figure 3 below.

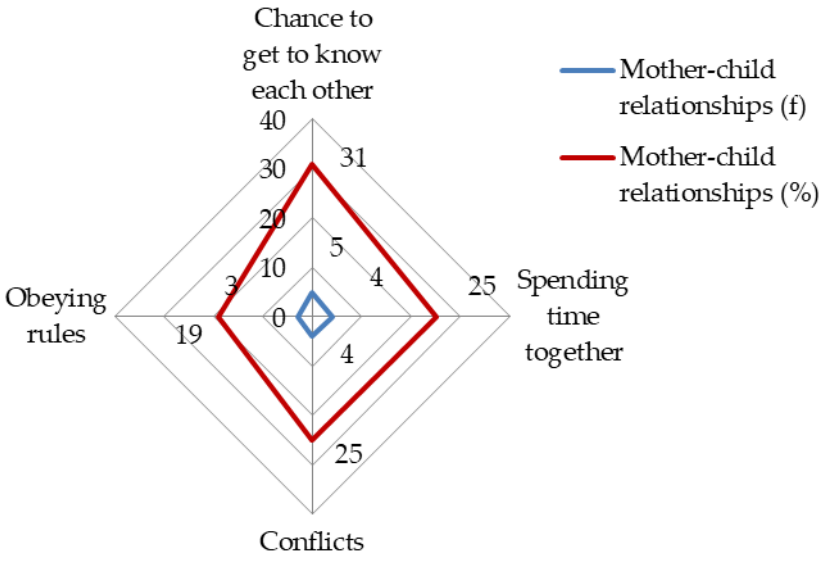

Figure 3. Mother-child relationship

Examination of Figure 3 reveals that changes were seen in the mother-child relationship during the pandemic period in 4 subthemes. These were expressed as the chance to get to know each other (31%), spending time together (25%), conflicts (25%), and obeying rules (19%), respectively. Participants' views related to these subthemes are shown below.

"This period had a partially negative effect on our relationship. Since our child could not see his friends or teachers, was unable to go out, and became very bored at home, he began to display rather peevish behaviours and his demands increased. As for me, during this period, I tried to prevent these and to explain that he would not be able to get everything he wanted." (P.3)

"To be honest, it was rather a tiring period. Staying at home, not being able to go out and being with us all the time tired him out. We had conflicts from time to time because he found it hard to obey rules that needed to be obeyed at home. We relaxed the rules during this time, but he only wanted more." (P.6)

"Because the number of things we shared increased, we had the chance to spend more time together and to get to know each other together. On the other hand, problems occurred regarding obeying the rules. Waking up time, playtime, bath time...everything became confused with leisure time and the concept of time became a process of 'I'll do it later'." (P.8)

"We did not experience any health or financial problems. As a mother that generally works, spending more time with my child made me happy. But of course, from time to time I experienced more flexibility and relaxation in my mutual relationship with my child. For example, I can say that the child began to more easily disobey rules that needed to be obeyed at home." (P.10)

"Staying at home for a long time made the child more active, and also more emotional and tearful. My child continually asks when the roads will be opened so that we can visit grandma and grandad, and cries. Her overactive state also makes me nervous, but I try to remain calm." (P.18)

When the findings related to the second research problem are examined, it can be said that during the pandemic period, participants had the opportunity to spend time together as mother and child, and in this context, to get to know each other better. This situation also shows that during normal times, the rapid pace of life leads to ruptures in relations between mothers and their children. Moreover, it can be said that children had difficulty in obeying rules due to being continually at home during the period of the pandemic, and that conflicts occurred between mothers and their children with regard to obeying rules.

3. Changes experienced in father-child relationships during the pandemic period

The aim of the third problem question of the research was to reveal changes that occurred in relationships between fathers and their children during the pandemic period. Changes that were experienced in the father-child relationship in the pandemic period according to the views of participants are shown in Figure 4 below.

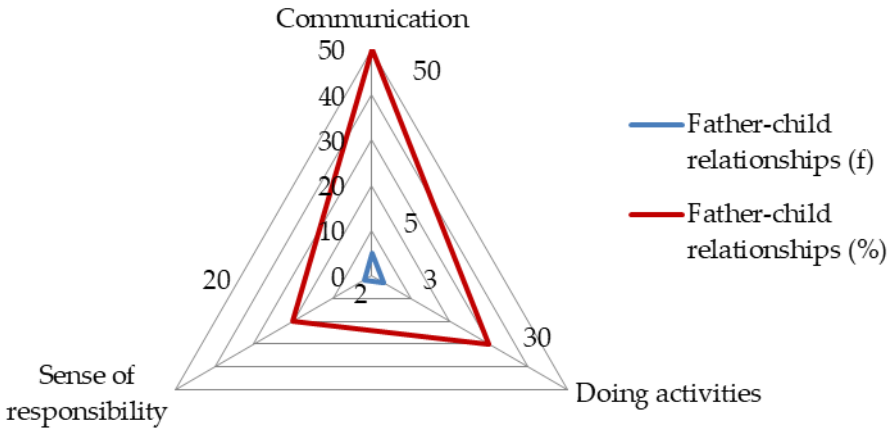

Figure 4. Father-child relationship

As can be seen in Figure 4, changes were observed in the father-child relationship during the pandemic period in 3 subthemes. These changes were stated to be related to communication (50%), doing activities (30%), and sense of responsibility (20%). Participants' views regarding these subthemes are given below.

"More togetherness was made possible, and the father's responsibilities and the child's perspective on the father changed. This had a positive impact on communication between them. We did activities and played games together. This also strengthened the bond between us." (P.8)

"Since work became part-time, we spent a lot of time together at home. We had the chance to get to know each other. We did more activities together while staying at home. These activities were both entertaining and instructional. This also strengthened the communication and bonds between us." (P.13)

"I think this period consolidated our relationship. I did not have much spare time in my life previously. During the pandemic, we did a lot of activities together and enjoyed ourselves. Now and again, he asked for his friends or did not obey the rules, but I responded positively to this." (P. 18)

"The children were stuck at home, could not go out and see their friends, and missed their teachers. They tried to spend their energy at home. At this time, they did not obey the rules. I had to warn them constantly. This put a strain on our relationship." (P.14)

Examination of the findings related to the third research problem reveals that participants emphasised communication between the father and child. This situation also reveals that fathers cannot normally spare enough time for their children in daily life. Moreover, it can be said that by spending more time at home, fathers became aware of their responsibilities. Participants also stated that they set aside more time for their children by doing activities with them.

4. Evaluation of relationships within the family

The fourth research problem question aimed for an evaluation by mothers and fathers of relationships within the family during the pandemic period. Figure 5 below includes an evaluation of relationships within the family in the period of the pandemic according to the views of participants.

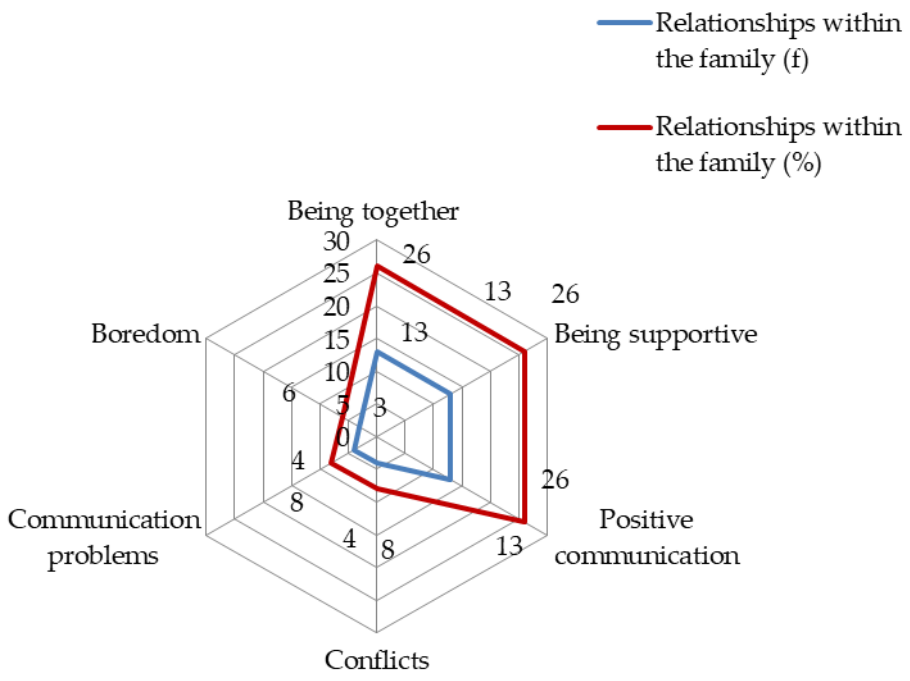

Figure 5. Evaluation of relationships within the family

It can be seen in Fig. 5 that relationships within the family during the pandemic are evaluated in 6 subthemes. These assessments were expressed as being together (26%), being supportive (26%), positive communication (26%), conflicts (8%), communication problems (8%), and boredom, respectively. Below, views of participants related to these subthemes are given.

"As a family, we did not have any negative experiences. We were pleased to be together, we supported each other at every opportunity, and we developed positive communication. This situation strengthened our family bonds." (P.16)

"Overall, my assessment is positive. This period taught us a number of values. Being together was good for all of us and we had the chance to get to know each other. Moreover, since we were together all the time, our communication also developed in a positive way." (P.17)

"I can say that it had a negative effect. Since we were together all the time during the pandemic, we became bored, and at times, we even had differences of opinion and disputes. This also caused breakdowns in family communication from time to time." (P.11)

When the findings related to the fourth research problem are examined, it can be seen that the participants mostly gave positive assessments of relationships within the family during the pandemic, and they stated that during this period, they were together, they supported each other and they established positive communication with each other. This situation shows that individuals preserve the importance of the concept of family and that even if conditions change, they continue to pay attention to relationships within the family. On the other hand, there were also parents who stated experiencing negative situations such as communication problems, conflicts and boredom due to spending long periods of time together. That could have been come in sight with differences of communication format in family members and with each other.

5. Activities carried out with children during the pandemic period

The aim of the fifth problem question of the research was to identify the activities conducted with children during the period of the pandemic. Activities carried out with children during the pandemic are included in Figure 6 below.

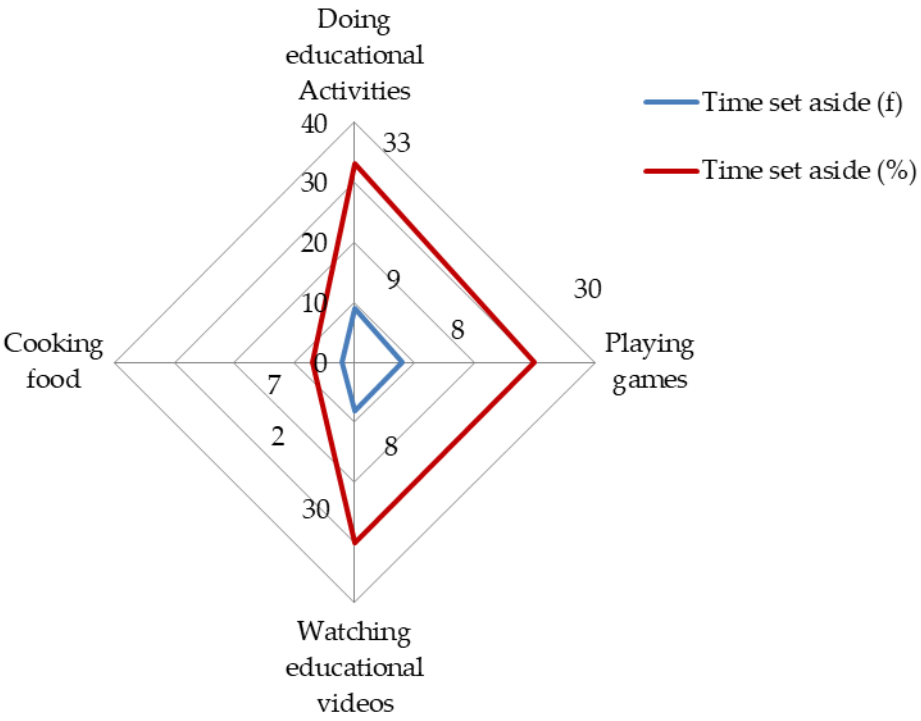

Figure 6. Activities carried out with children

Figure 6 shows that activities done with the children during the pandemic were carried out in 4 themes. These activities were stated to be doing educational activities (33%), playing games (30%), watching educational videos (30%), and cooking food (7%), respectively.

"Since the children didn't have school, we tried to give them support by doing educational activities at home. We communicated with their teacher and got through this period according to her recommendations. I think it was a successful period." (P.2)

"I can say it was spent productively. We carried out activities with educational features. Besides these, we played games. We sometimes made the game tools ourselves. These helped him to develop his manual skills. After a time, he wanted to do activities requiring handicraft." (P.5)

"Whilst not as enjoyable as school, we spent quite an entertaining time under pandemic conditions. We did housework together. She helped me. We cooked, baked cakes and cleaned together. She also got a lot of enjoyment out of this. Later, we rewarded her by playing games. We did educational activities together." (P.9)

"During this period, we had the chance to learn and discover many games. We played new games together every day. We made every effort possible to ensure that she didn't fall behind in her education. However, whatever we do, it cannot replace the education given at school." (P.12).

Examination of the findings related to the fifth problem of the research reveal that families generally attempted to conduct activities that have educational characteristics with their children. The reason for this situation may be that the families did not wish to let their children's education fall behind. Furthermore, it is seen that families took care to spend more productive time with their children by choosing to watch educational videos and play games. Making various activities to spend quality time which the families have made to support development of the children show that the families have awareness in this regard.

Results and Conclusion

All societies are faced with important problems at different times in terms of economic, educational, social, political or health aspects, and they attempt to overcome these alone or by obtaining support from other societies. However, certain problems go beyond affecting a single society or region and create effects on a global level, and problems such as these are known as pandemics. Most countries of the world have had to struggle with an epidemic disease that appeared at the end of 2019 and was declared a pandemic, and during this period, many individuals have spent a long time at home with members of their family. In this period, as a precaution, education was also suspended at first, and later, education by distance learning was begun. Students at all stages and in all classes took part in educational activities via distance learning under the control of their

teachers and families. During the pandemic period, which affected all family members in different ways, relationships within the family changed, and in this context, the aim of this study was determined as an in-depth examination of relationships and changes in relations between families and their children of preschool age during the period of the pandemic.

The first problem question of the research aimed to reveal the positive and negative aspects of the pandemic period in terms of the parent-child relationship. When the research findings are examined, it is seen that participants expressed the positive aspects of the pandemic period in terms of spending time together, sharing, doing activities and communication, while the negative aspects were stated to be social isolation, domestic conflicts and mobile phone dependency. According to these findings, from a positive viewpoint, it can be seen that most participants considered spending time together important and that this process contributed to their family perception. Moreover, the participants all agreed that sharing between family members increased, that time was devoted to doing joint activities, and that communication within the family improved as a result. Examining similar studies, it was also determined that positive changes occurred in parent-child relationships during the pandemic (Demirbaş-Kurt & Koçak-Sevgili, 2020), and that together with activities carried out with family members (Başaran & Aksoy, 2020), periods of interaction also increased (Lee & Ward, 2020). Considering the negative findings, however, the majority of the participants stressed their desire for socialisation and for this wish to be fulfilled. It can be said that for individuals who cannot satisfy their need for socialisation, conflicts occur in the families they are members of. This also reveals the importance of socialisation among basic human needs. In addition, it can be said that since the activities that families performed with their children during the pandemic were inadequate, children used their mobile phones or other technological tools more frequently. On the other hand, in studies related to problems experienced in the parent-child relationship during the pandemic, it was revealed that negative situations such as social isolation, intense stress (Amakiri et al., 2020; Brown, Doom, Lechuga-Peña, Watamura & Koppels, 2020), technology addiction, disruptions in nutrition habits (Başaran & Aksoy, 2020; Usta-Yüksek & Gökcan, 2020), increase in physical and psychological punishment (Lee & Ward, 2020), neglect, difficulty in following the education process and failure to use time productively were frequently experienced (Chung, Lanier & Wong, 2020**)**.

The second problem question of the research aimed to reveal the changes experienced in relationships between the mother and child during the pandemic period. When the research findings are examined, it is seen that the pandemic period caused changes in the mother-child relationship in terms of getting to know each other, spending time together, conflicts and obeying rules. According to these findings, it can be said that during the pandemic period, mothers and their children had the chance to spend more time together, and accordingly, to get to know each other better. This also shows that under normal circumstances, relations between mothers and their children may break down due to the rapid pace of life. Furthermore, it can be said that children had problems with obeying rules due to being at home all the time during the pandemic period, and that conflicts were experienced between mothers and their children in terms of obeying rules. Examination of similar studies reveals that since mothers stayed at home for long periods, they spent more time with their children, carried out various activities, and were happy with this situation (Öztürk-Demir, Kuru &Yıldız, 2020; Usta-Yüksek & Gökcan, 2020). On the other hand, it was revealed that since mothers transferred their work conditions to the home environment, due to changes experienced in their role expectations, their workloads became more difficult because of the increase in routine tasks such as cleaning and cooking at home (Akbaş-Zeybekoğlu & Dursun, 2020; Collins, Landivar, Ruppanner & Scarborough, 2020; Lee & Ward, 2020). Moreover, mothers' perception of wellbeing was negatively affected since they had to abandon their work lives. During this period, when parent burnout is frequently experienced, the fact that rates of child neglect have increased is also very disturbing in terms of domestic relationship**s** (Griffith, 2020).

The third problem question of the research aimed to reveal the changes that occurred in relationships between the father and child in the pandemic period. Examination of the research findings reveals that the pandemic period caused changes in the father-child relationship with regard to communication, doing activities and sense of responsibility. The research findings reveal that participants placed emphasis on communication between the father and child. This also shows that under normal circumstances, fathers cannot spare enough time for their children in their daily lives. In addition, it can be said that fathers became more aware of their responsibilities by spending more time at home. Participants also reported that by doing activities with their children, they were able to devote more time to their children. It can also be seen in similar studies that during the pandemic, changes have occurred in the sharing of tasks related to housework between parents, and that in this new arrangement, fathers are taking more interest with regard to care and education of their children at home (Mangiavacchi, Piccoli & Pieroni, 2020**)**. Many fathers have transferred to the system of working from home during the pandemic and at the same time, have taken on responsibility for childcare. In this period, when schools and kindergartens are closed and the general need for childcare has increased, fathers' responsibilities

have also increased. It is also likely that during the pandemic, when fathers spend more time with their children, the bond between them and their children will be strengthened (Alon, Doepke, Olmstead-Rumsey & Tertilt, 2020; Tamis-LeMonda, Shannon, Cabrera & Lamb, 2004).

The fourth problem question of the research aimed for an evaluation of relationships within the family in the period of the pandemic. Participants evaluated the positive aspects of relationships within the family as being together, supporting each other and positive communication, while the negative aspects were assessed as conflicts, communication problems and boredom. The research findings show that the participants mostly evaluated relationships within the family during the pandemic as positive, and they reported that during this time, they were together, they gave each other support, and they communicated with each other in a positive way. This situation shows that people preserve the importance of the family concept and that even when conditions change, they still show concern for relationships within the family. However, there were also parents who stated that they experienced negative situations such as disputes, boredom and communication problems because of spending long periods of time together. It has been determined in similar studies that during this period, domestic relationships have been affected both positively and negatively (Başaran & Aksoy, 2020; Demirbaş-Kurt & Koçak-Sevgili, 2020), and that family members respond to this situation in different ways (Daks, Peltz & Rogge, 2020; LaBrenz, Baiden, Findley, Tennant & Chakravarty, 2020; Lee & Ward, 2020). During the pandemic period, it is very important for parents to display a positive parental approach and to be sensitive to their children's individual needs, and for parent-child relationships to be strengthened by overcoming problems in daily life with empathy and respect (Johnson, 2020).

The fifth problem question of the research aimed to reveal the types of activities that were carried out by families with their children during the pandemic period. Participants stated that the activities they allocated the most time to were educational activities, playing games, educational videos and cooking food. According to the research findings, families generally tried to carry out activities that had educational characteristics with their children. The reason for this may be that families did not want to allow their children to fall behind in their education. Moreover, it can be said that by preferring to watch educational videos and play games, families took care to spend more productive time with their children. When similar studies are examined, it is revealed that children spend time at home by playing games or doing activities, but that an increase in their dependence on technology also occurs (Öztürk-Demir, Kuru &Yıldız-Demir, 2020). It is very important for parents to support their children from different developmental aspects by providing physical and emotional support during this period (Coyne, et al. 2020).

Conclusion

The changes occuring in health, social, economic and psychological fields during pandemic period has affected family life and communication of child-parent in a different way. Positive and negative effects has been occured in the communication of child-parent in this period. When the results of the research evaluated that has come out besides negative effects of pandemic period on family communication more positive effects has been experienced. It has been determined that the family members have spent more time and shared more with each other. Family members evaluated the positive aspects of relationships within the family as being together, supporting each other and positive communication, while the negative aspects were assessed as conflicts, communication problems and boredom.

It has been determined that some negative and positive differences have been experienced in mother and child relationship, the mothers have spent more time with the children and the time spending with them have increased. Besides it has been determined that staying at home for a long time cause conflicts over the rules in mother-child relationship. Also, positive changes have occured in father-child relationship in this pandemic period and the fathers have got the chance to strenghten the relationship by spending much more time with their children. It has been revealed that the family members are trying to spend quality time together by making different kinds of activities in pandemic period. Parents stated that the activities they allocated the most time to were educational activities, playing games, educational videos and cooking food.

In regards of these results it can be said that some changes have occured in the relationship of parent-child, pandemic period has affected the family members and relationship with each other negatively or positively.

Recommendations

The pandemic period may be one of the best times for parents to play more of a role in the care and skills development of their children, and to spend quality time with them by strengthening family ties, and for family members to share many things together. In this period, it is important for parents to play games with their

children so as to increase communication with them and to allay their fears and worries, and to engage in activities together like singing and dancing in order to encourage physical activity. In this period, when education is carried out mostly by parents, it is essential for them to be sensitive towards their children's individual characteristics and needs, and to help them to develop their capacity to control themselves. Moreover, parents should ensure that their children continue their everyday life rhythms and routine activities during the pandemic period. Instead of paying too much attention to information about the pandemic, children should set aside more time each day for activities aimed at manual skills with games that support physical and mental development. At the same time, children should be encouraged to communicate with their friends and family members via telephone or internet. During this period, state institutions can also help families to maintain domestic relationships by ensuring that families' basic needs such as food, shelter, clothing, safety, health and finances are met. It is also very important for inequalities between children in education to be removed in this period.

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International Journal of Contemporary Educational Research (IJCER)

www.ijcer.net

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To cite this article:

Kaya, D., & Ok, G. (2021). Problems encountered by mathematics and science teachers in classrooms where Syrian students under temporary protection status are educated and suggestions for solution. *International Journal of Contemporary Educational Research, 8*(1), 111-127. DOI: https://doi.org/10.33200/ijcer.774094

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International Journal of Contemporary Educational Research
Volume 8, Number 1, March 2021, 111-127 ISSN: 2148-3868

Problems Encountered by Mathematics and Science Teachers in Classrooms where Syrian Students under Temporary Protection Status are Educated and Suggestions for Solution

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Abstract

In this study, problems encountered by mathematics and science teachers in classrooms where Syrian students under temporary protection status and suggestions for solution to these problems were examined. A case study was used among qualitative research methods. 30 volunteer mathematics and science teachers from three state middle schools in the 2018-2019 academic year have attended the study in which criterion sampling was preferred. In the study where a semi-structured interview form was utilized, evaluation of the data was done through content analysis. As the result of this study, it was determined that Syrian students have problems particularly language and communication problems which are stemming from behavioral, parenting, economic, legislative, and their past lives. Underlying the problems encountered by mathematics and science teachers in their lessons is the Syrian students' not having sufficient language skills and having difficulties in perception and learning. Incompatibility of the curriculum, parents' perspective on education, having difficulties in dealing with problems and lack of materials are among the issues that teachers have problems in. The difficulty acquisition levels and course contents, the level difference between students, and the lack of training in the subjects are among the most common problems encountered by teachers in terms of the dimension of the curriculum. The suggestions of mathematics and science teachers are for the students and families to overcome the language problem, increasing the supplementary courses, providing material support, and providing support for the education of the families.

Key words: Mathematics teachers, Science teachers, Syrian students, Temporary protection status

Introduction

Without a doubt one of the most essential phenomenon of history is migration. Being a universal phenomenon, migration can be defined as a common name given to the movement of people from their locations because of economic, social, political, and cultural reasons (Koçak and Terzi, 2012). Another description is the act of moving from one country to another, from one settlement to another connected to specific reasons (Turkish Language Institution [TLI], 2019). Migration is a condition that can be observed everywhere on earth and has existed from the earliest history of humans and will continue to exist in the future (Koçak and Terzi, 2012). Therefore, migration both by its subject and both by its pattern is among the first topics on agendas not only in countries that receive large amounts of migration but in every geography that globalization is felt or experienced intensely, and concerns everyone and every structure (Directorate General of Migration Management [DGMM], 2017). Although there are many reasons for migration; wars, natural disasters, threats, medical services, education services, lack of employment areas are among the main reasons (Özgen, 2012). On many international agreements, it is emphasized that migration is a right (The UN Refugee Agency [UNHCR], 2016; 2019). However, migration is moving, holding on to life and power on one hand and is disengagement, escape, separation, sadness, loneliness, unfamiliarity even pain on the other (Irmak, 2019). Today, especially migration victims who are driven out of their places by force are defined as different concepts such as refugee, asylum-seeker, and migrant (Saraçlı, 2019). The concept of migration is defined as the physical location change of individuals or groups of people from one settlement area to another settlement area by will or by force, permanently or covering a certain period (GNAT Human Rights Review Commission, 2010). However, this change brings a multi-dimensional change as well. Especially social, economic, cultural, and political aspects

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affect the structure of society profoundly (Coşkun and Emin, 2016; Kasdemir, 2010; Oral and Çetinkaya, 2017; Özer, 2004). Therefore migration causes all layers of society to change by beyond just being an act of locational movement. Stemming from the fact that one in every seven people is a migrant, the era we are in defined as the "age of migration" and the size and universality of migration is emphasized (Castles and Miller, 2008; International Organization for Migration [IOM], 2018).

Turkey is one of the countries that received the most influx of migrants throughout history. The existence of an intense migration network in Turkey is stated by many official authorities (DGMM, 2017). Turkey is faced and is going to be faced with migration problems because of both its geographical and strategic position. Especially, the forced migration wave that began in April 2011 with an asylum-seeker group of 252 people has reached 3.6 million today as the civil war escalated (UNHCR, 2019). On the other side, Turkey hosts 400.000 other asylum-seekers from nearby countries, notably Afghanistan, Iraq, Iran, and Somalia (UNHCR, 2019). Especially after it is determined that the Syrian asylum-seekers are going to be staying in Turkey for a long time, it has been a necessity to develop long term policies that would also enable individuals to adapt to social life in addition to precautions taken to accommodate for their emergency needs (GNAT Human Rights Review Commission, 2010). Without a doubt one of the pillars of these policies is education. Because many social scientists; agree that the education is given to children under temporary protection status plays an important role in the healthy development of social adaptation (Castles and Miller, 2008; Machel, 2001; Miller, Mitchell and Brown, 2005; Saraçlı, 2019; Waters and Leblanc, 2005). On the other hand, the education process is where the most exposure to the adaptation process to both social and cultural differences of the host country by the children under temporary protection status occurs. So much so that education is an important step in adapting to social, financial, and cultural life in addition to being a basic human right (Emin, 2018). Today, in many international societies immigrant education is seen as a vital problem such as health, housing, food, and water (IOM, 2018; Machel, 2001; UNICEF, 2015). In this regard, day by day, regulations that would be developed for the education of children under temporary protection status who are born and raised in Turkey or included in the learning process subsequently have become important (Ministry of National Education [MoNE], 2015).

Access to the means of education and make use of the benefits of education is one of the basic human rights of migrant children also and all countries should provide these children with fundamental education (UNICEF, 2015). Intense work has been carried out for the education of the children under temporary protection status in Turkey and starting with 2016, policies have been developed so they would receive education in public schools for them to learn Turkish and adapt to the social, financial, and cultural structure (DGMM, 2017). Thus, the importance of the subject is emphasized by statements; "works will be conducted for refugees, foreigners under temporary protection or also those staying in Turkey as stateless to achieve integration to the education system for them to receive education for the duration they are staying" in the year 2015-2019 strategic plan published by Ministry of National Education (MoNE, 2015). As a result of these policies, as of January 2019, 645.000 Syrian children under temporary protection status who are registered to school are receiving education in Turkey (UNICEF Turkey National Committee, 2019). Despite of all these positive developments, children under temporary protection in Turkey have basic problems such as economic, health, language, social and education (Akdeniz, 2018; Başar, Akan and Çiftçi, 2018; Cin, 2018; Dağdeviren, 2018; Dolapcioglu and Bolat, 2019; Döner, 2016, Emin, 2018; Erdem, 2017; Erol-Emiroğlu, 2018; Güzel, 2019; Özer Komsuoğlu and Ateşok, 2016; Özgün, 2019; Polat, 2012; Şimşir and Dilmaç, 2018; Waters and Leblanc, 2005; Yıldız, 2018). In order to overcome these problems, it is considered very important to bring all children under temporary protection status to education and to ensure their adaptation to social life through education under temporary (IOM, 2018; MoNE, 2015; UNICEF, 2015; 2019). In this regard education activities play a key role in enabling these students to adapt to society and country and reducing adaptation problems that stems from various reasons (Güzel, 2019). On the other hand, with every passing day, some problems arise from the introduction of students under temporary protection to the education system. Notably language, many problems such as; legislation, academic success, curriculum, parity, social, cultural, economic, psychological, teacher, student, acceptance by parent and school managers, view of education by asylum-seeker families affect the learning environment (Bulut, Kanat-Soysal and Gülçiçek, 2018; Erdem, 2017; Jafari, Tonga and Kışla, 2018). Especially in educational institutions affiliated with the Ministry of National Education, Syrian students under temporary protection status who study Turkish in the same learning environment as Turkish students face many problems. under temporary. These problems lead to some negative situations for administrators, teachers, students under temporary protection, Syrian and Turkish students. In this regard, many works and studies are conducted, the problems encountered by students under temporary protection in education environment sought to be identified in the light of many variables such as teachers, managers, students, families, and education institutions (Akdeniz, 2018; Ergen and Şahin, 2019; Güngör and Şenel, 2018; Kiremit, Akpınar and Tüfekçi-Akcan, 2018; Şahin and Doğan, 2018; Şimşir and Dilmaç, 2018; Uysal, 2019). Considering all these negativities which were the starting point of the study being conducted, acknowledging the problems encountered by mathematics and science teachers in

classrooms with students under temporary protection status, emerges as a subject worth investigating. At the same time, a limited number of studies on the problems encountered by both mathematics and science teachers in related literature is considered important to the necessity of the study. Mathematics and science have an important place in all disciplines, so it is important to know the problems experienced in these two courses. Because the awareness of students to develop innovative solutions to the problems they see in their environment and the ability to produce these solutions by blending them with different disciplines such as mathematics and science has become one of the main goals of the education systems of developed countries (MoNE, 2018; OECD, 2011).

When the literature is examined, it is determined that refugee students face more communication difficulties in the learning process after interviews with 20 class teachers by Başar et al., (2018). At the same time related to students isolating themselves from the class environment, existence of adaptation and attitude problems have been reported. After interviews with 17 teachers teaching in different branches, it was determined that foreign students face academic, social, language, and communication problems (Başar et al., (2018). Another finding of the study was obtained from interviews conducted by Güngör and Şenel (2018) with 21 classroom teachers and 24 foreign students. As the result of the study, it is determined that foreign students experience more language and culture differences, basic language skills, understanding, expressing, and commenting, lagging behind the program, and academic failures in their education. In the study conducted by Ergen and Şahin (2019) with 160 classroom teachers, it was determined that the Turkish language and mathematics skills of Syrian students are not adequate, older students face adaptation problems. Moreover, it was determined that these students engage in reciprocated violence between themselves and with Turkish students, choose their friends internally, their school resources and parent participation are not sufficient. In the study conducted by Bulut et al., (2018) with 14 class teachers, it was identified that especially in Turkish lessons, the teachers used the same curriculum for both asylum-seeker children whose native language is not Turkish and other children; they didn't know how to resolve the language problems of these students and because of the lack of Turkish education process for foreigners, they are facing problems. As a result of interviews with 35 teachers conducted by Jafari et al., (2018), it was determined that although there are cultural and social differences, Syrian and Turkish students studying in elementary school do not experience a cultural conflict and the biggest difficulty preventing the cultural amalgamation is the language problem. Another study was conducted by Şahin and Doğan (2018) with 15 middle school science teachers. As the result of the study, it was stated that the leading problems faced in the science course education process of classes with Syrian students are language problems, cultural differences, adaptation problems, and lack of material. On the other hand, it is reported that learning acquisition of science courses are heavy for Syrian students, course content is heavy, the content is not finished on time, and the content needs to be visualized more. As the result of the study conducted by Kiremit et al., (2018) with 19 teachers, it was determined that the biggest problem Syrian students face is not knowing Turkish and having adaptation problems with their peers. At the same time, the biggest problem teachers with Syrian students in their classes are not being able to communicate and include them in the education process. Likewise; as the result of extensive interviews conducted with school managers, teachers, and Syrian families by Emin (2018), it was determined that at the center of the problems encountered by Syrian students in the education process is the language barrier. In another study conducted by Dağdeviren (2018), it was determined that Syrian asylum-seekers face economic, social, and cultural adaptation and integration processes. On the other hand, the existence of problems such as financial difficulties, work and work conditions, trust issues in social relations, and a shortfall of language were reported. As the result of interviews conducted with the school manager, school counselor, class teacher, Turkish teacher, and parents by Erol-Emiroğlu (2018), it was determined that Syrian students have language problems, age differences, communication gap, and a lack of book and materials.

When the studies in the literature are examined in general, it is seen that Syrian students under temporary protection status have more encountered with native language-based problems in their teaching (Başar et al., 2018; Bulut et al., 2018; Demir and Ozgul, 2019; Emin, 2018; Ergen and Şahin, 2019; Erol-Emiroğlu, 2018; Güngör and Şenel, 2018; Kiremit et al., 2018; Taskin and Erdemli, 2018). In addition to this, the existence of problems such as; self-isolation of these students from the class environment (Başar et al., 2018), communication problems (Güngör and Şenol, 2018; Jafari et al., 2018), a social-cultural difference (Dağdeviren, 2018; Şahin and Doğan, 2018), lack of material (Şahin and Doğan, 2018), lack of interest of Syrian parents (Erol-Emiroğlu, 2018) are noteworthy. In this regard, one can say that one of the fields where the sociological effects of migration are felt intensely is education services. As a result, considering Turkey has the potential to receive more migration and the fact that it became a target on this subject, the quality of the studies conducted on the problems encountered in migrant education is rather valuable. In this regard, the base subject of the study fictionalized is to examine the problems encountered by mathematics and science teachers in classes with Syrian students under temporary protection status and also to contribute to both educators and policymakers.

Method

Research Model

In the research, in order to reveal the problems encountered by mathematics and science teachers in classrooms with Syrian students under temporary protection status and their thoughts on the resolutions to these problems, a case study pattern has been used. The case study is a type of pattern within qualitative research that can be both the product and the object of the research (Creswell, 2018). The most important feature of qualitative case studies is to investigate a situation with a focus on depth and reveal the results related to that situation (Yıldırım and Şimşek, 2016). Researchers conducting basic qualitative research are interested in how people interpret their lives, how they build their world, and what meaning they add to their experiences (Meriam, 2013). Research including a situation study is an approach where the researcher gathers detailed and extensive information via multiple sources of information regarding a recent limited system or multiple limited systems in a limited time, real-life (Creswell, 2018). In this regard, the basic approach of the study is to examine the problems experienced or encountered by Syrian students under temporary protection, conditions that hinder their education and solution proposals in the light of views by mathematics and science teachers.

Study Group

The study group of the research consists of mathematics and science teachers from three public middle schools in downtown İzmir in the 2018-2019 academic year. 14 of these teachers are mathematics, 16 of them are science teachers. One of the purposive sampling methods, criteria sampling was preferred in a selection of the teachers who will take part as volunteers for the study. Trying to choose informatively rich situations to gather extensive information is the basic principle of purposive sampling (Creswell, 2018). In this method, choosing one or more special situations that meet the specified criteria or have specific features should be frequently preferred (Merriam, 2013). These criteria could be generated by the researcher as well as specified according to an existing criteria list and could be utilized to ensure successful representation of the people or events (Maxwell, 2005; Yıldırım and Şimşek, 2016; Yin, 2009). In determining the study group used in the research, teaching classes with Syrian students under temporary protection and having at least two years of experience in this field were specified as the criteria. On the other hand, in selecting middle schools, care was given for them to be located in areas where Syrian students under temporary protection are in high density. In this regard, 84 Syrian students are in classes that mathematics and science teachers are teaching. 36 of these students are in fifth, 33 of them are in the sixth, 7 of them are in seventh grade and 8 of them are in eighth-grade education. 14 of the teachers who were asked to give their opinions are female (46.7%), 16 of them are male (53.3%). Of these teachers 12 of them have (40%) 3-9 years, 10 of them have (33%) 10-19 years and 8 of them have (26.7%) have 20 or more years of experience. As per the research ethics, names of the teachers were kept private, participant mathematics teachers are coded as PM_1, PM_2, PM_3…PM_{14}, science teachers are coded as PS_1, PS_2, PS_3…PS_{16}.

Data Collection

In order to gather the opinions of participant that attend classrooms with Syrian students under temporary protection, a semi-structured form was utilized. In preparing the questions for the interviews, a first literature review was conducted and the questions in similar studies were examined and a draft form was created. The created draft form was presented for review of two field experts (science education and sociologist) and two-course teachers (mathematics and science) to achieve scope and appearance validity and according to the suggestions/requests interview form is finalized. In this regard, an interview form with open-ended questions was applied to reach demographic information of the participants and make it possible for participants to express their opinions in a detailed manner (Marshall and Rossman, 1999). The interview form that was created to gather data consists of six questions. For example: What do you think about the adaptation of students under temporary protection status to the Turkish education system? What kind of difficulties do you encountered in teaching mathematics to students under temporary protection status? What can be done for students under temporary protection status to learn science better? Participating teachers were in no way put under obligations, and the voluntary basis was followed. During the interviews, a voice recorder was used by receiving permission, and some statements deemed important were noted. Before interviews, school management was given information regarding the study, and interviews were conducted on available periods according to the class schedules of the mathematics and science teachers who wanted to be a part of the study.

Data Analysis

After the gathering of the data, without making any changes to the gathered data, the researcher moved directly to the transcription method. After the transcription process was completed, the data was read again by the researcher and the data analysis phase was started. Gathered data examined with content analysis method. Content analysis is the careful, extensive systematic examination of the acquired documents and interpreting in the light of gathered findings to determine the patterns, themes, and narratives (Berg and Latin, 2008; Leedy and Ormrod, 2005; Neuendorf, 2002). In a general sense, it can be applied through various communication channels including various text documents, photographs, videos, and voice records (Berg and Lune, 2015). In this regard, the data was gathered, transcribed, identified inductively, codes were transformed into categorical labels and themes, similarities and discrepancies classified by the researcher (Hsieh and Shannon, 2005). Credibility being an important problem in qualitative researches, many activities can be conducted to increase credibility (Creswell, 2018). For instance, as also done in the research, after acquiring the required release recording with a voice recorder and transcribing these may increase the credibility (Silverman, 2005). In addition to this, in analyzing the written data, multiple encoders could be used (Miles and Huberman, 1994). Usually, credibility in qualitative researches means stability in answers by multiple encoders on data sets (Creswell, 2018). In this regard, after the process of determining the draft themes was completed, codes were placed under the themes and opinions of two associate experts in qualitative studies were received. After corrections according to the expert opinion, the analysis process was concluded.

Findings

In this section, following the purpose of the study, findings obtained from the opinions of mathematics and science teachers are included. The determining themes and categories and codes relevant to the themes specified in the conducted content analysis were depicted on the table. On the other side, frequencies and the percentages related to themes were calculated and provided in the text. Additionally, they were supported by the findings gathered in the light of the codes determined directly via the opinions of the teachers. In the scope of the research, both mathematics and science teachers were asked a general question regarding the adaptation of Syrian students under temporary protection to the education system and according to the opinion of the teachers, gathered categories and codes were summarized in the table below.

Table 1. Findings regarding adaptation of Syrian students to the Turkish education system

Theme	Categories	Codes	f	%
Adaptation	Language and Communication	Inadequacy in verbal communication	26	86.6
		Weakness in social relations	16	53.3
		Isolation from the education environment	12	40.0
		Unwilling communication of Turkish students	6	20.0
		No language and communication problems	4	13.3
	Academic Problems	Difficulty understanding the lesson	24	80.0
		Problems in reading-writing	21	70.0
		Lagging behind education schedule	16	53.3
		Problems in doing homework	11	36.6
		Academic level difference	9	30.0
		No academic problems	4	13.3
	Behavioral Problems	Problems in following rules	10	33.3
		Undisciplined behaviors	7	23.3
		Behaviors such as fighting, violence	5	16.6
		No behavior problems	4	13.3
	Legislation Related Problems	Differences in curriculum	23	76.6
		Assessment and evaluation	13	43.3
		Attendance and absenteeism	6	20.0
		Early-childhood education	1	3.3
	Effects of Family	Differences in native language	28	93.3
		Cultural discord	27	90.0
		Family opinion on education	18	60.0
		Outsider psychology	5	16.6
	Economic Reasons	Procuring education material	21	70.0
		Problems related to nutrition	5	16.6
		Appearance problems	1	3.3
	Past Experiences	Effects of past experiences	24	80.0
		Effects on tutorials	19	63.3
		Effects on friend relationship	6	20.0

On examining Table 1, it is visible that the general opinions of the mathematics and science teachers regarding Syrian students under temporary protection are divided into seven different categories. These categories are language and communication, relate to academic, behavioral, legislation problems, effect of family economic status, and past experiences. According to the findings, mathematics and science teachers stated that Syrian students under temporary protection mostly experience problems such as inadequacy in verbal communication (86.6%), difficulty understanding the lesson (80%), differences in the curriculum (76.6%), and native language (93.3%), cultural discord (90%), procuring the education material (70%) and effects of past experience to the education environment (80%) in adapting to the Turkish education system. On the other hand, existence of adaptation problems such as; weakness in social relations (53.3%), problems in reading-writing (70%), lagging behind education schedule (53.3%), problems in following rules (33.3%), problems in assessment, and evaluation (43.3%), opinion of a family on education (60%), problems related nutrition (16.6) and effects of past experiences to the tutorials (63.3%) were stated. Aside from these; unwilling behavior of Turkish students (20%), academic level difference (30%), fighting and violent behavior (16.6%), attendance and absenteeism (20%), early childhood education (3.3%), appearance problems (3.3%), the effect of past experiences on friend relationship (20%) are presented among other problems these students are experiencing in adaptation to the education system. Statements of some mathematics and science teachers are as follows:

> *They feel lonely when they cannot talk or explain their troubles (PM_{13}). There may be problems making friends. Learning difficulties are experienced as they stay away from education (PM_{13}). Often there are problems in reading... There are difficulties in understanding all sentences (PS_2). Students are often shy, cannot express themselves, cannot communicate with anyone, they are unwilling (PM_{11}). We occasionally fall behind the annual plan. However, there are also good students (PM_8). There are students that I need to constantly remember the classroom rules (PS_9). While I am taking an exam, I may have problems in measurement and evaluation (PM_6). Some of my students are discontinuous too much in my course. So I have to deal with them later (PS_{15}). I think our cultural differences make it difficult for students to adapt to the course... Of course, there are economic reasons (PM_8). My students came to these places because of difficult conditions. I can understand them very well. We are always there and do our best. A difficult situation. Of course what they have experienced causes problems in their learning (PM_{13}). We cannot usually see their families. So I don't know most families. However, we know a few of them. They don't come to school much (PS_{12}).*

As the second research question to the mathematics and science teachers: What kind of difficulties are you facing in the education of students under temporary protection? The question was directed. In this regard, the findings gathered from the answers of the teachers to this question are presented below.

Table 2. Findings regarding problems encountered in mathematics and science education

Theme	Categories	Codes	In terms of Math Teachers		In terms of Science Teachers	
			f	%	f	%
Problems Encountered in Teaching	Student Related Reasons	Not having adequate language skill	12	85.7	14	87.5
		Having problems with perception and learning	11	78.5	13	81.2
		Adaptation problem to school and class environment	6	42.8	5	31.2
		Unwillingness in participation	5	35.7	7	43.7
		Joining the class environment subsequently	3	21.4	2	12.5
		Displaying behavior that is against classroom climate	1	7.1	1	6.2
	Teacher Related Problems	Trouble managing problems	10	71.4	8	50
		Inadequacies in teaching methods	6	42.8	9	56.2
		Problems in assessment and evaluation	6	42.8	7	43.7
		Professional inadequacy	2	14.2	1	6.2
	Family Related Reasons	Communication problem with family	13	92.8	15	93.7
		Opinion of family on education	9	64.2	9	56.2
		Education level of the family	6	42.8	5	31.2
		Lack of communication of family with school administration	5	35.7	6	37.5
		Family economic reasons	3	21.4	2	12.5
	Legislation Related Problems	Disparity of the education program	11	78.5	12	75.0
		Lack of material	10	71.4	11	68.7
		Shortcomings of education system	7	57.1	5	31.2
		Not utilizing the courses effectively	2	14.2	1	6.2

When Table 2 is examined, mathematics and science teachers discuss the difficulties they encountered in teaching Syrian students under temporary protection status in four different categories. These categories consist

of student, teacher, family, and legislation-related reasons. According to the findings, 85.7% of the mathematics teachers stated that the lack of adequate language skills of students, 78.5% stated that experiencing perception and learning problems, 71.4% stated that having trouble managing problems, 92.8% stated that experiencing problems communicating with the family, 78.5% stated that disparity in an education program and 71.4% stated that lack of material caused more problems in mathematics education. On the other side, 87.5% of the science teachers stated that the lack of adequate language skills of students, 81.2% stated that experiencing perception and learning problems, 56.2% stated that inadequacies in teaching methods, 93.7% stated that experiencing problems communicating with the family, 75% stated that disparity in an education program and 68.7% stated that lack of material problems in science education. Statements of some mathematics and science teachers are as follows:

> *One of the biggest problems situations between the students and us is the language problem. As the number of Syrian students in our school increases, the need for them to speak the Turkish language decreases. Students who know Turkish don't want to talk most of the time. They are like closed books. They don't open themselves up to us completely... They always create withdrawn structures. How can we get along with each other without talking... I often have difficulties in dealing with problems... For example, teaching mathematics or something to Syrian students who don't know reading-writing is rather difficult. Especially we are unable to communicate with families face to face. Families don't come to school often... Usually, they come when there is a problem... It would be better if there are quality additional sources or different course materials that are appropriate for the mathematics education of these students. There are serious problems in learning mathematics especially for children who joined the learning environment subsequently. Because their base is not well established, there are problems in making sense of new learnings (PM_2).*

> *I think the biggest problem between us and the children is the language difference. I think this situation causes communication problems. We are unable to understand their shortcomings because students are unable to express themselves in classrooms. Communication problems lead to misunderstandings and a lack of expression. Most of the time we are experiencing problems in learning abstract concepts. They do not participate in science courses or even if they have the eagerness to participate they may be thinking they would be unable to express themselves fully. We are unable to speak with the families often. Families do not come to school often. I think the biggest concern of the families is the financial struggle. Because education seems not important to them... In many of the students, the disparity of education is very apparent. When we move to another learning environment, it seems something is always missing in students. It could be an issue stemming from their previous learnings. I need adequate materials more (PS_4).*

Table 3. Findings including the difficulties of the course progress in terms of the dimensions of the curriculum

Theme	Categories	Codes	For Mathematics Teachers		For Science Teachers	
			f	%	f	%
Curriculum Dimensions	Learning Acquisition Related Reasons	The difficulty of the level of acquisition	8	57.1	9	56.2
		High number of acquisition	7	50.0	10	62.5
		Shortness of acquisition times	7	50.0	8	50.0
		Problems in teaching acquisition	6	42.8	5	31.2
	Content Related Reasons	Difficulty of course content	10	71.4	8	50.0
		Lack of visuals	9	64.2	10	62.5
		Language and communication inadequacy	3	21.4	4	25.0
	Process Related Reasons	Problem in understanding and commenting	11	78.5	13	81.2
		Not being able to complete the course	10	71.4	11	68.7
		Level difference between students	6	42.8	7	43.7
		Shortness of class time	5	35.7	4	25.0
		Unwillingness in class participation	5	35.7	7	43.7
		Inability to provide enough information	2	14.2	1	6.2
	Assessment Related Reasons	Problems in language and communication	6	42.8	7	43.7
		Making exams below class level	4	28.5	5	31.2
		Settling for vocal assessment	1	7.1	2	12.5

When Table 3 is examined, mathematics and science teachers discuss the difficulties of Syrian students under temporary protection status in terms of the dimensions of the curriculum in four different categories. 57.1% of mathematics teachers mentioned the difficulty of learning level of acquisition, 71.4% mentioned the difficulty of course content, 78.5% mentioned problems in understanding and commenting and 42.8% mentioned assessment problems related to language and communication problems more. 62.5% of science teachers mentioned several

acquisition achievements being high, 62.5% mentioned inadequacy of visuals, 81.2% mentioned problems in understanding and commenting, and 43.7% mentioned assessment problems related to communication and language problems. Statements of teachers regarding this theme are as follows:

> *Teaching students new things within the education program is the goal of each of us however, we are experiencing problems in learning acquisition. Subject achievements with a more abstract content structure are especially hard for students. However, I try my best to approach the subject achievements appropriate to the student level. Problems are related to process increases in sections with hard achievement levels. For example, students have difficulties when the subject is algebra. In this case, students are not able to obtain some achievements fully. Because we follow the yearly schedule, these students lag, especially on subjects with a lot of acquisitions. Therefore the development of their understanding and commenting skills are not healthy (PM_7).*

> *Most of the time science course contents are hard for students. When the content is hard, I am unable to achieve my desired level in some achievements. For example, the achievement level of subjects with physics content is hard for these students and they have difficulties. Because we are unable to establish decent communication, I have difficulties in understanding which subject the students learned well and which subjects they have not. In time, I try to lower the level according to the level of students that I've gotten to know, however in this case setbacks in learning of subjects with multiple achievements occur. Problems in providing enough information occur... (PS_{11}).*

Table 4 . Findings gathered related to the suitability of the course books to the level of students

Theme	Categories	Codes	For Mathematics Teachers		For Science Teachers	
			f	%	f	%
Coursebook	General Opinion	Suitable	3	21.5	2	12.5
		Not Suitable	11	78.5	14	87.5
	Suitable Aspects of Coursebook	Visuals are enough	5	35.7	6	37.5
		Activities suitable for students	4	28.5	5	31.2
		Adequate content	3	21.4	4	25.0
		Adequate assessment	1	7.1	2	12.5
	Improper aspects of coursebook	Course content level	11	78.5	12	75.0
		Native language is different	9	64.2	10	62.5
		Lack of visual content	9	64.2	10	62.5
		Limited number of activities	8	57.1	9	56.2
		Inadequate assessment	6	42.8	7	43.7
		Content and the writing of texts	1	7.1	1	6.2

When Table 4 is examined, mathematics and science teachers approach the suitability of the coursebooks used in the teaching Syrian students under temporary protection in three different categories. These categories are; general opinion, suitable and not suitable aspects of the coursebook. According to the findings gathered; 78.5% of the mathematics and 87.5 of the science teachers opined that the coursebooks are not suitable. 35.7% of the mathematics teachers and 37.5% of the science teachers believe that the visuals in books are adequate. Aside from these, 78.5% of the mathematics teachers think because of course content level, 64.2% think because of the native language difference, 64.2% think because of the lack of visual content, 57.1% think because of a limited number of activities, and 42.8% think because of the inadequate assessment the books are not suitable. 75% of the science teachers think that because of the course content level, 62.5% think because of the native language difference and lack of visual content, 56.2% think because of the limited number of activities, and 43.7% think because of the inadequate assessment the book is not suitable.

> *Mathematics book is not appropriate for the level of students, it is above it. Students should receive language education first and then the education of other courses should begin. It does not make much sense to teach mathematics to students who have trouble understanding Turkish. Mathematics book should be prepared appropriately to the level of students... I think there should be a separate mathematics books for these students... The visuals and visual expositions in the book are not adequate. Activities appropriate for students are limited... If these students and Turkish students are going to be subjected to the same mathematics education, there is a need for a more advanced course content level (PM_9).*

> *Many parts of the science book are not suitable for the education of students. It would be better for these students if there were more visuality. It could be easier for children to be taught some concepts*

when they look at the pictures. It would be better if there are more example activities for Syrian students in science books. Something should be done in assessing the students... There should be assessment sections in coursebooks or in study aids for these students to understand what they understood well and what they didn't. All in all, even if the quality and the content of the book are good, the shortcomings of students related to the language difference should be made up for (PS_{13}).

Table 5. Findings related to the subjects that students have difficulty in learning

Theme	Categories	For Mathematics Teachers	f	%	For Science Teachers	f	%
Difficult Issues in Learning	Subjects that are Difficult to Learn	Rational numbers	11	78.5	Subjects with physics	11	68.7
		Algebraic statements	10	71.4	Subjects with chemistry	10	62.5
		Equality and equation	8	57.1	Subjects with biology	7	43.7
		Ration-Proportion	7	50.0	Force and movement	6	37.5
		Polygons	6	42.8	Matter and heat	6	37.5
		Circle and circumference	6	42.8	DNA and genetic code	6	37.5
		Multipliers and multitudes	5	35.7	Pressure	5	31.2
		Exponential statements	4	28.5	Propagation of light	3	18.7
		Square root statements	3	21.4	Electric circuits/charges	2	12.5
		Geometric shapes	1	7.1	Basic machines	1	6.2
		Area and volume measures	1	7.1	-	-	-
	Subjects that are Easy to Learn	Natural numbers	5	35.7	Solar system	6	37.5
		Integers	3	21.4	Human and Environment	3	18.7
		Angles	2	14.2	Subjects with biology	3	18.7
		Rational Numbers	1	7.1	Systems in our body	2	12.5
		Percent	1	7.1	Matter and transformation	2	12.5
		Polygons	1	7.1	Reproduction in creatures	2	12.5
		Data analysis	1	7.1	Propagation of light	1	6.2
	Reasons for Difficult Learning	Language and contact	12	85.7	Language and contact	14	87.5
		Lack of study aid	9	64.2	Inability to subject	9	56.2
		Lack of additional books	7	50.0	Abundance of abstract	7	43.7
		Lack of visual content	6	42.8	Lack of visuals	5	31.2
		Lack of family support	3	21.4	Lack of material	4	25.0
		Level difference	1	7.1	Lack of family support	1	6.2
	Reasons for Easy Learning	Concretization	4	28.5	Narration through video	5	31.2
		Visualization	3	21.4	Use of visual material	5	31.2
		Participation in class	2	14.2	Use of models	3	18.7
		Good communication	2	14.2	Show and exercise	2	12.5
		Previous learnings	2	14.2	Good attitude of teacher	1	6.2
		Teacher support	1	7.1	-	-	-

According to the findings in Table 5, subjects that Syrian students under temporary protection have trouble learning gathered under four categories according to the opinions of mathematics and science teachers. These categories are; subjects that are hard to learn, subjects that are easy to learn, reasons for difficult or easy learning. Mathematics teachers stated that students encountered difficulties notably in rational numbers (78.5%), algebraic statements (71.4%), and equality and equation (57.1%). Science teachers stated that students have difficulty in learning subjects with physics (68.7%) and chemistry (62.5%) content. 35.7% of mathematics teachers stated that operations with natural numbers and 21.4% stated that operations with integers are learned by students easier. 37.5% of the science teachers mentioned the solar system, 18.7% mentioned that humans and the environment, and 18.7% stated that subjects with biology are learned by students easier. For mathematics teachers among the notable reasons for having difficulty in learning are language and contact problems (85.7%) and lack of study aids (64.2%). For science teachers, this matter is stated as language and contact problems (87.5%) and inability to make sense of the subject (56.2%).

Students struggle especially on rational subjects. It is rather hard to teach algebra subjects. It is relatively easier to teach operations with natural numbers. I think the most important reason why students struggle in learning is language. The reason is that students act timid because of communication inadequacy. There are no study aids or materials that help Syrian students to learn. Additionally, many families do not keep up with their children on what they are learning in class. Therefore many mathematics subjects are rather hard for students. I think one of the reasons why students learn easily or learn some subjects easily is that they set themselves to work. In this regard, immense responsibility falls to us, teachers. If the participation of the students is increasing, they learn better (PM_5).

It seems that when it comes to subjects with physics and chemistry content, students do not understand anything. It seems to me many of them stare vacantly. I experience difficulties teaching especially force and movement. These are subjects that Turkish students also struggle with. While many Turkish students whose mathematics is not potent are experiencing problems understanding force and movement subjects, trying to teach Syrian students this subject becomes problematic. Language inadequacy is the biggest obstacle between us and the students... I think the education of Syrian students should be carried through different books. Even if we are in the same class environment, there should be more study aids available for these students. If students are included in the learning environment, they learn easier. For example, if students make models or example visualization in a solar and lunar eclipse, they learn better (PS_{16}).

Table 6. Findings gathered regarding better education of mathematics and science courses

Theme	Categories	Codes	f	%
Suggestions	Student	Students should learn Turkish language	22	73.3
		Student should participate in class	19	63.3
		Students should be willing to learn	17	56.6
		Students should attend school regularly	5	16.6
		Students should resolve their information gaps	3	10.0
	Teacher	Student attention should be gathered	15	50.0
		Use of different teaching techniques	15	50.0
		Having more visual material	13	43.3
		Prioritizing social activities	3	10.0
		More communication with families	2	6.6
	Family	Families should overcome the language problem	24	80.0
		Families should support education	22	73.3
		Families should cooperate with schools	5	16.6
	School	Increase number of supplementary courses	14	46.6
		Families should be brought into education	6	20.0
		Organize harmony activities	3	10.0
	Ministry of National Education	Provide material support	20	66.6
		Book content should be rearranged	18	60.0
		Should offer more compliance training	7	23.3
		Should open educational courses for families	3	10.0
		Should educate managers	1	3.3

When table 6 is examined, teacher opinions regarding better mathematics and science education of Syrian students under temporary protection are gathered under five different categories. These categories are; student, teacher, family, school, and Ministry of National Education. According to the gathered data, teachers opined more that to learn their courses better, they need to learn the Turkish language (73.3%), participate more in class (63.3%), and they need to be more willing to learn (56.6%). On the other hand, among the responsibilities that fall to teachers, they stated the need for gathering student attention (50%), use of other methods and techniques (50%), use of visual material more (43.3%). Among the responsibilities that fall to the families, they opined more on that they need to overcome the language problem (80%) and they need to support education (73.3%). As a school, they opined more on making efforts to increase the supplementary courses (46.6%) and bring the families into the education (20%). Teachers expressed their opinion that the Ministry of National Education should provide material support (66.6%) and rearranged the content of the book (60%).

The most immediate need of our students is to learning the Turkish language. In this regard, we need to make more efforts in their learning of the Turkish language. If our Syrian students speak and understand the Turkish language beautifully, they will understand mathematics better. We need to encourage our students in participating in mathematics classes more and we need to spend more time with them in this direction As teachers, to draw their attention, visual materials can be used more and our ministry can provide means of additional resources for us in this direction. Various methods and techniques can also be used. For example showing and exercising, activities with game themes or drama. However, applying these also requires different timeframes and locations. Families should support education and we should be able to communicate with them healthily. More additional courses can be opened for these students. More material support for the education of Syrian students should be provided and should be a different mathematics book for them (PM_{14}).

Science courses are actually courses that all students can learn while having fun however be it level differences, be it language problems we are unable to use time efficiently in science courses with Syrian students. Especially in the teaching of abstract concepts, Syrian students do not ever want to

participate in class and this is why I am making more effort in making them active in classes. If they are more willing, I am sure we can overcome many difficulties. Also, there should be a supportive teacher guidebook for teachers regarding different methods and techniques that could be used in the education of Syrian students. If there was a science set heavy with visual material we could help these students more. Also, families should come to school more often... They should support the education of their children more... Families should also receive language education... (PS_1).

Conclusion and Discussion

In the scope of the conducted research problems encountered by mathematics and science teachers in classrooms where Syrian students under temporary protection receiving education and suggestions for solutions to these problems are examined. As widely known, Turkey is a country that receives continuous migration because of its location. Therefore it continuously encounter some problems related to migration. Without a doubt, one of the most important ones of these problems is the subject of the education of children that come into Turkey. So much so that the education problem of migrant children is not only Turkey's problem, rather among the basic problems of many countries (Machel, 2001; UNICEF, 2015). Although many policies and works are done as a country, related to the continuous nature of migration, adaptation problems of children under temporary protection status to our education system continue (UNHCR, 2016). Therefore, education problems caused by migration becomes a global issue, and satisfying the education needs of migrant children takes on a critical meaning. In this research, problems encountered by mathematics and science teachers in classrooms containing students under temporary protection status were examined according to the opinions of these teachers and it was aimed to reveal them extensively. According to the findings gathered from the research, problems encountered by teachers in mathematics and science education were gathered under different themes and these themes are explained according to categories.

According to the acquired findings, mathematics and science teachers stated that they encountered language and communication, academic, behavioral, legislative, parent, economic and past experience-related problems in an adaptation of Syrian students under temporary protection status to the Turkish education system. This finding also confirms the results of similar studies in the literature (Başar et al., 2018; Erol-Emiroğlu, 2018; Güngör and Şenel, 2018; Jafari et al., 2018; Kiremit et al., 2018; Şahin and Doğan, 2018; Şimşir and Dilmaç, 2018). According to Koçak and Terzi (2012), some positive and negative conditions may arise as a result of migration. Migrant individuals maintain their own lives in places they migrated to and they are unable to break off from their culture. This situation causes them to be otherized by other urban dwellers and causes cultural conflicts. Hence, this situation is also true for students under temporary protection status that have to continue their lives in Turkey. While under the influence of a specified culture and environment in a specified timeframe, these students suddenly transferred to an unfamiliar environment that is beyond their own culture and language. In this regard, it is rather natural for these students to experience problems related to notably language and communication, academic and past experience. Drawing attention to this situation, Güngör and Şenel (2018) indicate that in the education of foreign students, they experience more language and cultural differences, basic language skills, understanding, expression, and commenting, lagging behind schedule, and academic failure problems. Therefore, problems of students who came to Turkey and start their education with the language problem and their parents in adapting to the traditions of Turkey are felt in the education environment. Thus, reasons such as inadequacy in verbal communication, weakness in social relations, and isolation from the learning environment are depicted among the adaptation problems in language and communication by mathematics and science teachers. Additionally, difficulties in understanding the course, problems in reading-writing, lagging behind the learning environment, and problems in doing homework are depicted as adaptation problems experienced in academic problems. On the other hand, problems in following rules, undisciplined behavior are described as adaptation problems in behavior problems. According to mathematics and science teachers, at the helm of the problems related to legislation are differences in curriculum and assessment and evaluation processes. Native language differences of families, cultural incompatibility, acquiring education materials, nutritional problems, and past experience are other adaptation problems mentioned by teachers. Thus, these findings coincide with the discourse in the literature of Syrian students having adaptation problems such as language, communication, legislation, and past experiences (Başar et al., 2018; Coşkun and Emin, 2016; Erdem, 2017). Therefore, Syrian students under temporary protection's access to education and resolving the adaptation problems in continuing education have separate importance. Supporting the development of these students with good education, increasing precautions for them to learn the Turkish language, overcoming communication problems to raise qualified individuals, children having a positive interaction with each other starting from an early age and making Turkey education system appropriate is important for the harmonization.

Another finding of the research is gathered from the difficulties encountered by mathematics and science teachers while teaching Syrian students under temporary protection status. According to this, mathematics and science teachers mostly experience problems related to students, teachers, family, and legislation. According to mathematics and science teachers, lacking adequate language skills, experiencing perception and learning problems, problems in adapting to school and class environment are the main problems related to students in classrooms. These findings validate the discourse that migrant students' pre-learning is rather lacking and they encountered problems in school and class environment related to language problems (Cin, 2018; Erdem, 2017; Uysal, 2019; Şahin and Doğan, 2018). For problems related to themselves, they expressed experiencing troubles in managing problems, feeling of inadequacy in teaching methods, the existence of problems in assessment and evaluation. The cause of another problem encountered by teachers is specified as family. Especially the opinion families regarding education and communication problems experienced with families are obstacles ineffective learning of mathematics and science. Incompatibility of the education program and lack of materials are among the main problems experienced by mathematics and science teachers in the learning environment. All of these findings are coincide with the discourses mentioned in the literature that foreign students receive education at schools in Turkey brings along many needs and problems (Akdeniz, 2018; Cin, 2018; Dağdeviren, 2018; Dolapcioglu ve Bolat, 2019; Emin, 2018, Güzel, 2019; Machel, 2001; Özgün, 2019; Waters and Leblanc, 2005; Yıldız, 2018). In the study conducted by Şahin and Doğan (2018) similar findings were gathered, the most important problems students experienced with science teachers are specified as language problems and cultural differences. According to Erdem (2017), it was stated that the teachers did not utilize education strategies appropriate to the need of migrant students. Thus, many teachers feel inadequate in utilizing education methods. According to Kasdemir (2010), both children who speak Turkish very well and children who do not know it at all receiving education in the same educational environment and using the same materials brings together problems such as academic performance, inability to socialize, distorted communication, inability to express themselves, becoming isolated. Drawing attention to this, Güzel (2019), specifies that students are experiencing difficulties in understanding Turkish and therefore are unable to use Turkish efficiently and be successful in their classrooms. In a similar matter, especially the problem of not knowing Turkish is the most important mentioned the most by students, parents, teachers, school administrators, and personnel and managers of Provincial National Education (Uysal, 2019). Therefore, while many problems diminish the efficiency of learning in classes with migrant students, the time they will spend on them and the period where the teachers get to know these students hinders the education efforts. According to Coşkun and Emin (2016), problems experienced by students in adapting to the school and class climate can lead to students alienating away from education and afterward, them dropping out of school. Especially reasons such as the difference experienced in education systems and lack of professional activities for Turkey teachers in to raise their awareness on this subject and the opinion of the families regarding education can be listed among the important reasons that effect the learning level of students. Hence the large proportion of the migrant students state that the Turkish education system is very different from the education system in their own countries, learning activities are not adequate for them and their families are not adequately interested in their education (Emin, 2018; Ergen and Şahin, 2019; Güzel, 2019; Uysal, 2019).

Another finding of the research includes the difficulties in the course process related to the size of the education program. According to the mathematics and science teachers, quality, number, and time of achievements in courses create difficulties for students under temporary protection. The difficulty of course content, lack of visuals, lack of language and communication, existence of problems in understanding and commenting, inability to complete the course, level differences, and experiencing problems in assessment and evaluation are listed among other difficulties. Gathered data confirms the discourse in the literature that the most important problem in the learning of the students is the differences in education program (Erol-Emiroğlu, 2018; Güngör and Şenel, 2018; Kiremit et al., 2018). Şahin and Doğan (2018) stated that the achievements of science courses are heavy for Syrian students and they are struggling to gain these achievements. Additionally, it was emphasized that the course content of the science class is heavy, content needs more visualization, and problems in language-communication-understanding are experienced. Therefore, suitability, level, and time of the achievements in mathematics and science education are considered as an important barrier. However, in the current situation there are no legislation, method, or long term policy that was constructed related to the adaptation of the migrants to the education processes (Coşkun and Emin, 2016). In this regard, achievement, content, and process-related reasons mentioned by mathematics and science teachers also affect the quality of learning activities.

Another finding of the research is gathered related to the suitability of the existing mathematics and science coursebooks to the Syrian students under temporary protection. The majority of the mathematics and science teachers, stated that books are not suitable for students, visuals are not adequate and the number of activities is limited. This finding confirms the findings determined by Şahin and Doğan (2018) that the science coursebook

is a problem for these students and the subjects are heavy. This situation causes rather serious problems for migrant students who continue their education in the same education program as Turkey students (Bulut et al., 2018). Drawing attention to this situation, Güngör and Şenel (2018) emphasize that the government needs to create an education program suitable for the needs of these students and prepare coursebooks according to the levels of students. However, preparation of coursebooks or materials is considered to be rather valuable in the integration of these students into the education system, communicating with their peers and teachers, and gaining basic language skills (Kiremit et al., 2018). In this regard, the content that is planned to be served to the students needs to be analyzed according to the readiness of the student and needs to be rearranged if needed (Erdem, 2017). On the other hand, opinions such as there are adequate visuals, suitable content and no problems in assessment and evaluation are also encountered. Syrian students starting their elementary education in Turkey and the students' efforts in classes can be mentioned among the most important reasons for this situation. When all of these ramifications are evaluated together, it can be beneficial to diversify the content of mathematics and science coursebooks and provide additional resources in which the needs of the students are considered. Because, during the course period, mostly coursebooks are used, however, books used are designed for Turkish students, they are inadequate for migrant students (Erdem, 2017).

Another finding gathered from the research consists of the subjects in mathematics and science courses that students under temporary protection status have difficulty in learning. According to the mathematics teachers, students struggle while learning rational numbers, algebraic statements, equality, and equation subjects. Although there are many reasons for this situation, according to the mathematics teachers, the base reasons are language and communication inadequacy and lack of additional resources and study aids. On the other hand, the basic mathematical skills that the students have can be problematic. According to Ergen and Şahin (2019), teachers state that the Syrian students do not have adequate mathematics skills and this situation is felt exceedingly. Another reason could be that the teachers strictly sticking to the content of the coursebook and not choosing a different application related to content for migrant students (Erdem, 2017). According to the science teachers, students struggle more in subjects with physics and chemistry content. Language and communication, inability to make sense of the subject, an abundance of abstract concepts, and lack of adequate visuals are listed among the reasons for struggling. These findings are parallel with the findings gathered by Şahin and Doğan (2018). In the study conducted by Şahin and Doğan (2018), science teachers stated that Syrian students are struggling notably in subjects of force and movement, light and reflection, planets, reproduction, and development. Similarly, language, communication and understanding problems, an abundance of abstract concepts are listed among the reasons for difficulties in learning. Findings gathered from the study confirm the findings of the study conducted by Şahin and Doğan (2018) and reveals that the students are experiencing difficulties in learning science. According to the mathematics teachers, Syrian students learn operations with natural numbers and integers easier. According to the teachers, prioritizing concretization and visualization are listed among the reasons for learning easily. The science teachers stated that when the subjects are taught using videos and visual materials, students learn the subjects easier. Drawing attention to this situation, Erdem (2017), when the conditions of the students are taken into consideration, it is hard for them to learn the same content with Turkish students without using any support. Therefore, provided means and course materials procured by the teachers provide important advantages for the students to learn easier.

As the last research question of the study, mathematics and science teachers' opinions related to the better learning of the courses were asked. The majority of teachers expressed that students will learn the lessons better if they know the Turkish language well, their participation in the lesson increases and they are more willing to learn. They stated that in case of drawing the attention of the students who are in the classes they attend and using different education techniques and materials, migrant students will understand their courses better. In this regard, these students not understanding or making sense of mathematics and science courses because of the native language difference comes across as a basic problem. When teacher opinions are considered, it seems unlikely that these students will be proficient in mathematics and science, unless efforts to overcome the language problem gains momentum. Thus, drawing attention to this situation, Polat (2012) states that the academic success of the students are low because of the difference in the native language, they are unable to adapt to the education system, unable to participate in activities and skill lessons, have trouble understanding and unable to fulfill their responsibilities and homework. Therefore, it is obvious that there needs to be more effort in enabling the students to use the Turkish language efficiently. On the other hand, teachers have opinions that the students' course success will increase if the families overcome the language problem and support education. It is stated that increasing the number of supplementary courses and drawing families into education by school partners will have a positive impact on the course success of the students. Increasing the material support and rearranging the content of the books from the Ministry of National Education are among the expectations of the teachers. According to Başar et al., (2018), for migrant students who are receiving education in Turkey, problems in communication, perception, cultural, past experiences and legislation and lack of family

support lead to problems in the learning process (Şimşir and Dilmaç, 2018). In this regard, in preventing the problems experienced by students it can be beneficial to increase school-family cooperation and concentrating on guidance activities. All in all, Syrian students under temporary protection receiving education in schools in Turkey brings many needs in tandem. Therefore, there is a need for a mathematics and science education program arranged according to these students, a learning environment that will satisfy the needs of the students, learning materials designed for each course, and activities to raise the awareness of families. In the light of the findings gathered from the study, some proposals were presented below.

Recommendations

- This study was conducted with middle school mathematics and science teachers. Similar studies can also be conducted for teachers on various education levels.
- The study was limited to the opinions of mathematics and science teachers. In addition to these opinions, the opinions of many more education partners notably managers, families, and students could be asked.
- In order to compensate for the academic deficiencies of Syrian students who migrated to Turkey, compensation programs can be implemented within the scope of separate planning for mathematics and science courses in schools.
- Providing standards for parities of Syrian students who came to Turkey with migration and establishing an assessment-evaluation unit in this regard can prove to be beneficial.
- As the mathematics and science teachers reflected in their opinions, the language barrier effects the learning environment immensely. Therefore, Turkish education courses for both students and families can be increased.
- In addition to the in-service activities that can be conducted for teachers, works in education of the migrant students at faculties of education where new teachers are raised can be conducted. At the same time, studies regarding what can be the different methods and techniques that could be used in classes related to the education of these students, how to increase in-class management and guidance activities, and the correct use of efficient communication strategies can be conducted.

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To cite this article:

Limon, İ., Dilekçi, Ü., & Demirer, S. (2021). The mediating role of initiative climate on the relationship between distributed leadership and organizational resilience in schools. *International Journal of Contemporary Educational Research, 8*(1), 128-144. DOI: https://doi.org/10.33200/ijcer.829411

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International Journal of Contemporary Educational Research
Volume 8, Number 1, March 2021, 128-144 ISSN: 2148-3868

The Mediating Role of Initiative Climate on the Relationship between Distributed Leadership and Organizational Resilience in Schools

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Abstract

This study investigated the mediating role of initiative climate on the relationship between distributed leadership and organizational resilience in schools. The study employed a cross-sectional design following quantitative methods. The sample consisted of 310 teachers recruited from different cities located in seven geographical regions of Turkey in 2020-2021 academic year using convenience sampling. Data were collected online (Google Forms) using the *Distributed Leadership Inventory*, *Personal Initiative Scale*, and *Organizational Resilience Scale*, all of which had acceptable validity and reliability. Participants *"agreed"* with initiative climate and organizational resilience in schools and school principals' distributed leadership behaviors. There were positive correlations between the variables. The results showed that distributed leadership (leadership coherence and leadership functions) fosters initiative climate and organizational resilience in schools. Initiative climate also contributes to organizational resilience in schools. Lastly, it can be said that distributed leadership has a significant effect on schools' resilience through initiative climate.

Key words: Distributed Leadership, Initiative Climate, Organizational Resilience.

Introduction

School leadership is becoming increasingly important in education in the 21st century, particularly in terms of educational reform and school development (Bush, 2016). There is a large body of research on school leadership, paving the way for numerous alternative and competitive models, such as distributed leadership (Gronn, 2010; Gümüş, Bellibaş, Esen & Gümüş, 2018), which is defined as a type of leadership whereby employees interact and become involved in managerial decisions, actions, and processes (Spillane, 2005). In distributed leadership, the main focus is on the distribution of leadership functions among members of an organization (Yukl, 2018), and collaboration lies at the heart of distributed leadership (Harris, 2010). Therefore, distributed leadership, which is an alternative to traditional leadership approaches (Kılınç & Arslan, 2020), is increasingly attracting the attention of educational organizations today, where cooperation, coordination and specialization are becoming increasingly important in the face of rapid flow of information and competition (Cemaloğlu, 2019).

School principals should be both leaders and influential figures because changes in education bring uncertainty, which shows that schools should have a climate of initiative. On the other hand, a school with stakeholders' taking initiative is likely to have higher organizational resilience because they take initiative to overcome the problems to achieve organizational goals (Yukl, 2018). Resilient organizations can overcome challenges more easily, contributing to the capabilities of an organization, strengthening, and providing greater flexibility in the face of new activities (Vogus & Sutcliffe, 2007). However, it is not possible in todays' dynamic and turbulent environment for principals to create and maintain resilience at schools by themselves. Therefore, they should share their responsibilities with other stakeholders as much as they can. Distributed leadership can significantly generate a climate of initiative and improve school performance because teachers who assume some of the school responsibilities and take initiative are more likely to develop positive feelings and thoughts towards their schools. This allows them to collaborate with their colleagues, resulting in increased commitment and loyalty to ensure organizational success (Taşkın, 2016). Moreover, school principals' distributed leadership also improves

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organizational resilience in the face of drastic changes (Andersson, Cäker, Tengblad & Wickelgren, 2019; Coutu, 2002; Horne, 1997; Linnenluecke, 2017).

In literature it is stated that there is a lack of profound understanding of the factors that might create and foster organizational resilience in terms of management and staff functioning (Shani, 2020). Drawing on this gap in literature, this study focused on principal leadership and schools' resilience since the mechanisms through which resilience of schools can be improved have not been clarified in literature yet. We, therefore analyzed the relationships among distributed leadership, climate of initiative and resilience of schools in this study. In this sense, the current study makes several contributions to the literature. First, it extends little research on organizational resilience in schools. Second, it provides insight into the effect of school leadership on resilience of schools and third, into the mechanisms that boost that effect.

Distributed Leadership

In recent years, there has been a growing interest in distributed leadership to facilitate its transition from an informal to formal context (Leithwood, Mascall, Strauss, Sacks, Nadeem & Yashkina, 2007). C. A. Gibb (1913-1994), an Australian leadership theorist, coined the term *"distributed leadership"* in his book "*Handbook of Social Psychology*" (1954) (Gronn, 2002). Research on education focuses mostly on instructional leadership, teacher leadership, transformational leadership, or distributed leadership (Gümüş et al., 2018), the last of which is a dynamic process involving superior-subordinate interaction (Liu, Bellibaş & Printy, 2018). That dynamic process also shows how important interaction in distributed leadership is (Spillane, Halverson & Diamond, 2001). School principals and teachers interact to fulfill leadership responsibilities together, and therefore, play a key role in executing distributed leadership (Liu et al., 2018). In distributed leadership, the school principal, managerial team, and teachers serve various leadership functions (Liu, 2020). Distributed leadership focuses on the delegation of leadership, distribution of responsibilities, and joint decision-making in schools (Liu & Werblow, 2019). According to Lashway (2003), distributed leadership requires that school principals delegate some of their responsibilities to school staff or distribute leadership to all stakeholders. Menon (2013) defines distributed leadership as functions shared by all members of an organization rather than one person's monopoly over them. Distributed leadership is interested in making use of know-how wherever it is, rather than having it in the organization merely for the sake of having it (Arslan & Ağıroğlu Bakır, 2014; Harris, 2004). Therefore, distributed leadership can be achieved only when leadership functions are distributed among school stakeholders (Baloğlu, 2011; Louis, Murphy, Mayrowetz & Smylie, 2013; Rutherford, 2009). Hulpia, Devos, and Rosseel (2009a) approach distributed leadership from three different perspectives: (1) *formal distribution of support and supervision of leadership functions*, (2) *leadership team coherence*, and (3) *participation of all school stakeholders in decision making*. As for distributed leadership, Elmore (2000) seeks answers to how employees can adopt a new working style, what methods should be used to enable them to take responsibility in activities to generate new ideas, and what types of reward systems those activities should involve.

Schools are knowledge-intensive organizations where leadership should be carefully distributed (Spillane, 2005). Therefore, distributed leadership requires that teachers perceive their roles differently and assume in-and-out-of-class responsibilities (Murphy, 2005). However, leadership can be distributed differently (Ritchie, 2005). The first is *collaborative leadership*, which highlights teacher-teacher collaborative interactions. In other words, a teacher's actions feed off and into her interaction with other teachers, encouraging his/her to try new things and share them with his/her colleagues. The second is *coordinated leadership*, where teachers, alone or in collaboration with their colleagues, perform different tasks assigned or coordinated by a leader. The third is *shared distribution*, where leadership is shared between two or more leaders who work separately yet interdependently. On the other hand, MacBeath, Oduro, and Waterhouse (2005) classify leadership distribution as formal, pragmatic, strategic, incremental, opportunistic, and cultural phenomenon. *Formal distribution* of leadership is based on a job description or an assigned role. *Pragmatic distribution* is the distribution of workload to achieve specific goals. *Strategic distribution* is assigning tasks to employees to help them develop leadership skills. *Incremental distribution* is to give more responsibility to employees as they prove their ability to exercise leadership. *Opportunistic distribution* is used in situations where capable teachers interested in assuming more responsibility extend their roles to school-wide leadership. And lastly, *cultural distribution* is a type of leadership reflecting culture, values, and traditions. Spillane and Mertz (2015) argue that distributed leadership is based on two fundamental assumptions: (1) *not only school principals but also other staff are involved in school administration*, and (2) *a theory of leadership should focus on leading or managing rather than on the actions of the leader*.

Given the explanations above, we can state that distributed leadership is about expansion rather than possession (Harris, 2008) and involves numerous educational components and feeds almost entirely off educational settings

(Göksoy, 2015). According to MacBeath et al. (2005), three phases of distributed leadership are assigning responsibilities to others (*delegation*), widening the scope of leadership to others with no formal leadership (*expansion*), and creating a culture of self-confidence and shared goals (*mutual trust*). Schools have goal-oriented systems and employees with different levels of competence. Therefore, it is of paramount importance to bring together all stakeholders under the umbrella of distributed leadership to achieve goals. This productive and collaborative climate is a hallmark of a cooperation, which suggests that distributed leadership is essential for schools (Aslan & Ağıroğlu Bakır, 2015). It promotes the dissemination of knowledge and turns schools into units where stakeholders can work on and discuss different ideas and strategies (Sesky, 2014). Distributed leadership pays particular attention to communication and cooperation between teacher leadership, student leadership, parent leadership, and other school-related leadership types. However, it does not ignore or downplay the formal leader (school principal) but gives him/her the responsibility of keeping stakeholders together and increasing their productivity (Harris, 2004).

Initiative Climate

Employees who interact with and can take initiative within the organization when necessary have positive thoughts towards their organizations, work in harmony with other employees and strive to increase their success (Taşkın, 2016). This positive climate within an organization promotes personal initiative. An organizational climate of initiative is also about personal initiative through proactive motivation and self-efficacy (Hong, Liao, Raub & Han, 2016). Personal initiative is defined as a set of proactive behaviors to overcome obstacles and achieve work-related goals and tasks (Fay & Frese, 1998, 2000, 2001; Frese, 2001; Frese, Fay, Hilburger, Leng & Tag, 1997; Frese, Kring, Soose & Zempel, 1996). It is generally about subproblems of a task or issues that are not entirely related to the task. Personal initiative sometimes implies that one assumes the responsibility of an idea that one has not executed yet (Frese, Garst & Fay, 2007). According to Fay and Frese (2001), the components of initiative climate are environmental support, knowledge and skills, cognitive abilities, and motivational factors (personality traits and orientations). Similarly, personal initiative is affected by three environmental factors: control in the workplace, job complexity, and support by the organization and the manager. An employee motivated by those factors is more likely to exhibit self-initiated behaviors to overcome obstacles and achieve goals. Control in the workplace and job complexity are the factors with the greatest impact. In order for an employee to take initiative, s/he should have a positive and comprehensive understanding of the job; that is, she should have job-related know-how, skills, and cognitive ability. Both personality traits and orientations determine what type of action one might take, while orientation is behavioral tendencies with moderate situational specificity (Fay & Frese, 2001).

Employees with personal initiative can take self-initiated and proactive action to overcome obstacles and achieve goals (Frese, 2000, 2001; Frese et al., 1996; Hahn, Frese, Binnewies & Schmitt, 2012; Warr & Fay, 2001). However, their initiative may sometimes be disheartened by stakeholders who do not support a change or do not recognize an action which is not directly related to the organizational mission (Fay & Sonnentag, 2002). In this sense, self-efficacy is an important factor. It plays a partially mediating role between control and complexity and simultaneous initiative (Speier & Frese, 1997). Self-efficacy results in personal initiative and higher performance at work (Hakanen, Perhoniemi & Toppinen-Tanner, 2008; Lisbona, Palaci, Salanova & Frese, 2018). Employees also believe that personal initiative is about organization, management, working team, and an emotional bond with career (Den Hartog & Belschak, 2007). There are two ways to approach innovative behavior: initiative and creative. *Initiative behavior* is self-initiated, proactive, and long-term behavior displayed to overcome challenges and achieve goals. It takes self-initiated action time and effort to improve an idea enough to put it into practice. One is expected to be interested in one's job to start thinking proactively about an idea. Before making a proposal, a school principal should consider three variables; having an idea, making a recommendation, and the quality of the recommendation (Frese, Teng & Wijnen, 1999). *Personal initiative*, which increases the responsibility at the beginning of the creative process, is positively related to creativity as an output (Binnewies, Ohly & Sonnentag, 2007). On the other hand, personal initiative contributes significantly to both qualitative and quantitative creativity (Herrmann & Felfe, 2014) and increases entrepreneurial success (Glaub, Frese, Fischer & Hoppe, 2014). As can be seen, employees who take initiative can produce outcomes that are important for organizations.

Organizational Resilience

Resilience is defined as a person's capacity to successfully adapt to stressful situations and maintain mental well-being in the face of adversity. It also refers to coping with challenges and turning them into an advantage to improve the current position (Kantur & İşeri-Say, 2015). Today, just like individuals, organizations are also expected to develop resilience to cope with uncertainty, hold their ground in the face of crises, and promote

success (Duchek, 2020). Resilience helps organizations use their cognitive, emotional, relational, and structural resources to resolve uncertainty and consists of flexible, storable, transformable, and formable processes (Sutcliffe & Vogus, 2003; Vogus & Sutcliffe, 2007).

Organizational resilience is addressed from two dimensions: planned and adaptable (Lee, Vargo & Seville, 2013; Nilakant, Walker, Van Heugten, Baird & De Vries, 2014; Prayag, Chowdhury, Spector & Orchiston, 2018). The former involves restructuring in the face of destructive change (Horne & Orr, 1998; Kantur & İşeri-Say, 2015; Somers, 2009) and the latter is about the ability to adapt to possible crises (Barasa, Mbau & Gilson, 2018) and adapting to problems (Zhang & Liu, 2012). As a response to multiple destructive events (Back, Ross, Duncan, Jaye, Henderson & Anderson, 2017; Paton, Smith & Violanti, 2000; Sahebjamnia, Torabi & Mansouri, 2018), it highlights the need for an adaptive approach to complexity and unpredictability (Andersson et al., 2019). It also requires system agility and robustness to survive and thrive (Kuntz, Malinen & Näswall, 2017).

Organizations perform analyses to understand their capacity and maintain performance in the face of adversaries, from internal crises to large-scale external influences (Linnenluecke & Griffiths, 2011). Intra-organizational structures and processes and extra-organizational factors indicate potential sources of protection and vulnerabilities at the organizational level. Chronic stressors caused by individual demands, restrictions, and inadequate resources are combined with individual characteristics (orientation, personality, values, and skills) that one turns to in the face of stressors (Riolli & Savicki, 2003). Organizational resilience gives a clue as to how an organization and its employees adapt to problems (Vogus & Sutcliffe, 2007). The kind of work, how, where, and with whom they do it always change. Therefore, employees should learn how to be resilient and adopt positive behaviors depending on the situation they are in (Mallak, 1998).

Crises also provide organizations with the opportunity to make new connections and reach new stakeholders (Chewning, Lai & Doerfel, 2013; Pal, Torstensson & Mattila, 2014; Rudolph & Repenning, 2002; Teixeira & Werther, 2013) because resilience is about accurate analysis of crises (Korkusuz & Kutluk, 2015) and turning adversity into an advantage (Günsel & Dodourova, 2018; Kumbalı, 2018; Öztürk, 2018). Unexpected events may occur in or outside the organizations. Different factors (type, time, place, frequency, and duration) affect organizations differently (Duchek, 2020). Organizations with resilience should manage their human resources strategically to make their employees more resilient, and hence, competent in the face of surprising and mostly unfavorable and uncertain situations (Annarelli & Nonino, 2016; Lengnick-Hall, Beck & Lengnick-Hall, 2011). Additionally, resilient organizations use financial, relational, structural, and technological resources differently than less resilient ones (Chewning et al., 2013). Therefore, organizational resilience can be addressed from a structural perspective specified by the complexity, variation, and distribution of activities among professional groups (Tillement, Cholez & Reverdy, 2009).

As stated above, resilience is based on the ability to communicate and restructure in the face of rapid changes or crises (Chewning et al., 2013; Ishak & Williams, 2018; Lengnick-Hall & Beck, 2005). Schools are exposed to changes (Limon & Sezgin-Nartgün, 2020) and other unexpected situations very frequently which brings the resilience to their agenda as a prominent issue. Although there is an abundance of research on school leaders' (Day, 2014; Özmusul, 2017), students' (Franklin, 2017) and teachers' resilience (Day & Hong, 2016; Haeussler, 2013; Hong, 2012; Taylor, 2013), few studies investigated the resilience of educational organizations. For example, a study conducted by Sezen-Gültekin (2019) revealed that resilience in higher education institutions had a significant effect on sustainability and was affected by organizational myopia. Weller and Anderson (2013) on the other hand, handled resilience in higher education institutions in terms of digital changes. A recent study in Israel has shown that resilience of schools is associated with social capital, team empowerment and goal interdependence (Shani, 2020). In the same study, it has also been stated that resilience of school is positively associated with functioning in crisis. Mirzaei et.al. (2020) examined the resilience of schools in disasters and the findings showed that it is directly associated with the functional, educational, safety, structural, nonstructural, architectural, commute routes, locational, and equipment domains. Resilience is of critical importance for schools because resilient schools will be more successful in terms of student achievement in the long-term than those showing fewer resilience characteristics (Norman et al., 2005 cited in Prada, 2007). Therefore, schools should build resilience. At *Regional Consultation Meeting on Education and Resilience* supported by UNICEF and UNESCO experts suggested nine priority paths to make schools more resilient against conflicts and crises (UNICEF, 2015). These are as follows:

- Analyzing the risk of conflict and crises,
- Inclusion of conflict and disaster risk reduction in the education sectors' planning and budgeting,
- Building a school safety framework within the planning,
- Adopting curriculum and textbooks for social cohesion and school safety,
- Providing equitable and safe access to education for all,

- Monitoring and evaluating the progress of initiatives for reducing risks,
- Fostering coordination and networks,
- Building a stronger education governance and encouraging local participation,
- Building capacity for risk reduction.

Relationships between Distributed Leadership, Initiative Climate, and Organizational Resilience in Schools

Today, we expect more from school principals than ever before, putting more responsibility on their shoulders and making them busier. This has made traditional school leadership obsolete (Lashway, 2003) and distributed leadership common in schools because it assigns different roles to all staff and assumes that they have different interests and strengths, taking advantage of which makes them more motivated. Besides, schools are too complex to be managed and transformed by one person. Therefore, school leadership should be shared among stakeholders rather than put in the hands of one person (Göksoy, 2015; Grenda, 2011; Lashway, 2003). When the leadership at schools are distributed, it may result in a better understanding and improvement in school problems (Timperley, 2005). Previous literature provides evidence for positive associations between distributed leadership and teachers' organizational commitment (Akdemir & Ayık, 2017), trust in colleagues and principals (Beycioğlu, Özer & Uğurlu, 2012; Mascall, Leithwood, Straus & Sacks, 2008), school culture and teachers' self-efficacy (DeMarco, 2018), collective teacher efficacy and organizational citizenship behaviour (Mascall et.al. 2008). These findings show that distributed leadership may result in desirable consequences for school organizations. Although, there is no prior study examining the relationship between distributed leadership and initiative climate, drawing upon aforementioned studies it can be said that when the leadership is distributed among stakeholders, a school environment convenient for initiative is created.

The style of leadership adopted can be influential on the resiliency of organizations (Karaköse, 2019; Teo, Lee & Lim, 2017). When leaders ensure the involvement and contribution of relevant stakeholders to decision making process, they nurture the resilience of organizations by building trust, empowering, motivating and creating commitment (Barasa et.al. 2018). In this sense, it can be anticipated that distributed leadership can contribute to the resilience capacity of organizations since it can make organizations more productive and responsive (Harris, 2011). Thus, Al-Harthi and Al-Mahdy (2017) found that distributed school leadership is a significant predictor of school effectiveness which includes efficiency, adaptability, and flexibility. On the other hand, Harris (2004) states that there is evidence suggesting that distributed leadership can contribute to school improvement. In another study, Kershner and Mcquillan (2016) highlights the importance of distributing authority as a precursor to adaptive change in schools. To enhance their organizational resilience capacity, schools need to be flexible, adaptive, and responsive in case of crises and challenges. As put forward by previous research, distributed school leadership may result in qualities which can boost resilience.

The basic ingredient of a resilient organization is *"a committed work force that is free to give the maximum effort"* (Deevy, 1995 cited in Gabriel, 2015) which points out the potential power of initiative climate as an antecedent of resiliency. Thus, initiative climate is characterized by self-initiated and proactive action to overcome obstacles and achieve goals (Hahn et al., 2012). When employees adopt such behaviors in favor of their organizations, it may contribute to overall resilience capacity in the organization since organizations depend on the actions taken by individuals in case of challenges. In crisis and change periods carrying out only responsibilities in formal job descriptions may not suffice. A cross-sectional study conducted in aviation sector revealed that organizational citizenship behaviors play a significant role in enhancing corporate resilience (Gabriel, 2015). On the other hand, Kim (2020) found that organizational resilience was positively associated with employees' intentions for proficiency, adaptivity, and proactivity. As for schools, Dlamini (2005) stated that the most distinctive aspect of resilient schools compared to non-resilient ones is the involvement of all stakeholders. In other words, it can be said that the more teachers and other school staff take initiative the more resilient schools can be built.

Change and uncertainty in schools make organizational resilience all the more important. Therefore, school principals should play a facilitating role in developing communication and information networks in schools (MacBeath et al., 2005). School culture should be conducive to distributed leadership (Printy & Liu, 2020) because teaching and distributed leadership play a vital role in the way the school climate promotes interaction, respect, and trust. Effective teaching and distributed leadership help school principals build respect and trust among teachers (Bellibaş & Liu, 2016) because distributed leadership ensures that all school stakeholders can benefit from all the wealth of the school. In such an environment where there is mutual trust and effective communication, teachers can take more initiative which in turn can also contribute to organizational resilience. Therefore, this study investigated the mediating role of the climate of initiative between distributed leadership

and organizational resilience in schools. Based on the relationships mentioned above, the following hypotheses were suggested:
H_1: Leadership functions significantly predicts organizational resilience.
H_2: Leadership functions significantly predicts initiative climate.
H_3: Leadership team coherence significantly predicts organizational resilience.
H_4: Leadership team coherence significantly predicts initiative climate.
H_5: Initiative climate significantly predicts organizational resilience.
H_6: Initiative climate mediates the relationship between leadership functions and organizational resilience.
H_7: Initiative climate mediates the relationship between leadership team coherence and organizational resilience.

Method

This section describes the research design, study sample, measures, and data collection and analysis procedures.

Research Design

This is a quantitative study employing a cross-sectional survey design. A cross-sectional study produces a *'snapshot'* of a population at a particular point in time (Cohen, Manion & Morrison, 2005).

Sample

This is an internal validity study which does not aim to generalize the findings to a population but to reveal the relationships among variables (Kaya, 2015); so, it was not carried out on a population. However, in order to have a relatively more nationwide representative sample we reached teachers from different cities located in all seven geographical regions of Turkey. The sample consisted of 310 teachers (163 women; 147 men) recruited through convenience sampling (Patton, 2002). Considering the sample size, it is enough since there are fewer than five constructs in our model with more than three items which requires a minimum of 100 participants (Hair, Black, Babin & Anderson, 2014). Of participants, 237 (76.5%) had a bachelors and 73 (23.5%) had a master's degree. Fifteen participants (4.8%) were preschool teachers, 65 (21.0%) primary school teachers, 93 (30.0%) secondary school teachers, and 137 (44.2%) high school teachers. Thirty-eight participants (12.3%) had 0 to 5 years, 59 (19.0%) had 6 to 10 years, 51 (16.5%) had 11 to 15 years, 67 (21.6%) had 16 to 20 years, and 95 (30.6%) had ≥21 years of experience.

Data Collections Tools

Data were collected using three different measures. Detailed information is presented below.

Distributed Leadership Inventory
Participant' perceptions of distributed leadership in their schools were determined using the *Distributed Leadership Inventory (DLI)* developed by Hulpia et al. (2009b) and adapted to Turkish by Özdemir (2012). The DLI consists of two subscales; (1) leadership functions (13 items; sample item: "*The principal explains his/her reason for criticism to teachers*.") and (2) leadership team coherence (10 items; sample item: "*Members of the leadership team know which tasks they have to perform.*"). The first subscale items are scored on a 5-point Likert-type scale (1=Never to 5=Always). The second subscale items are also scored on a 5-point Likert-type scale (1=Strongly Disagree to 5=Strongly Agree). The first subscale evaluated the perceptions of principals, head assistants, and assistant principals separately. The results showed that the subscale was valid and reliable for each task, and therefore, participants were asked to evaluate only their principals in line with the aim of the current study. Özdemir (2012) reported that the subscales of *"leadership functions"* and *"leadership team coherence"* had a Cronbach's alpha (internal consistency) of .96 and .98 for school principals, respectively.

Initiative Climate Scale
To measure initiative climate, we used the scale developed by Frese et al. (1997) to measure individual level initiative and adapted to Turkish for organizations by Kurt, Duyar, and Yakut (2015). The scale has a unidimensional structure with seven items (Sample item: "*Whenever something goes wrong in the school, people search for a solution immediately.*") scored on a 5-point Likert-type scale; (1=Strongly Disagree to 5=Strongly Agree). Turkish version of the scale had a Cronbach's alpha of .87 (Kurt, Duyar & Yakut 2015).

Organizational Resilience Scale

The level of resilience in schools was measured using *Organizational Resilience Scale (ORS)* developed by Kantur and İşeri-Say (2015). ORS consists of three subscales and nine items (sample item, "*The organization I work for put up resistance not to lose in the face of unexpected/sudden or critical/bad situations*.") scored on a 5-point Likert-type scale; (1=Strongly Disagree to 5=Strongly Agree). Sezen-Gültekin (2019) used ORS for higher education organizations and established its validity and reliability again. Results showed that the Turkish version of ORS had a unidimensional structure with a Cronbach's alpha of .95.

We also calculated the goodness of fit indices and Cronbach's alpha to establish the validity and reliability of the scales within this study. Table 1 presents the findings.

Table 1. Goodness of Fit Indices and Internal Consistency Coefficients

Scale	x^2	df	x^2/df	RMSEA	CFI	SRMR	α
LF	165.57	59	2.81	.08	.97	.03	.96
LTC	83.48	31	2.69	.07	.99	.02	.97
IC	19.76	9	2.20	.06	.99	.02	.95
OR	60.58	20	3.03	.08	.99	.02	.97

Note: LF: *Leadership functions*; LTC: *Leadership team coherence*; IC: *Initiative climate*; OR: *Organizational resilience*

As the findings in Table 1 indicates the scales had validity (Hair et. al. 2014) and internal consistency (Singh, 2007) within the scope of current study.

Data Collection

The study was approved by the Ethics Committee of Batman University (No:2020/5-17). Data were collected online through Google Forms. The researchers sent an electronic link to school principals in different provinces located in seven geographical regions of Turkey whom they knew and asked them to share the link on their schools' WhatsApp groups.

Data Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS 25.0) and Analysis of Moment Structures (AMOS 23.0) (Arbuckle, 2019). First of all, the data set were scanned to see if there were missing values and there were none of them. Afterwards, skewness and kurtosis values were calculated to check the distribution. Skewness (-.799 to -.607) and kurtosis (.080 to .700) ranged between the cut off values of -1.5 and +1.5, suggesting that data were normally distributed (Huck, 2012). Minimum-maximum values, arithmetic means, and standard deviations were calculated within the descriptive statistics. Pearson's correlation coefficient was used to reveal the relationships between the variables. On the other hand, simple mediation was used to determine the predictive relationships between the variables (Hayes, 2013; Karagöz, 2016; Sümer, 2000). Mediation models are used to account for the effect of an independent variable on a dependent variable. Before mediation analysis, the multivariate normal distribution was evaluated using multivariate kurtosis and its critical ratio (Byrne, 2016). The multivariate kurtosis and critical ratio were 669.930 and 104.290, respectively, suggesting a multivariate non-normal distribution. Therefore, the data were analyzed using the nonparametric bootstrapping with a confidence interval (CI) of 95% (Şimşek, 2007).

Findings

This section presents findings of descriptive analysis and structural equation modeling.

Descriptive Findings

Table 2 shows the descriptive statistics and correlations.

Table 2. Descriptive Statistics and Correlations

	Descriptives				Correlations			
Variable	**Min.**	**Max.**	**Mean**	**SD**	**1**	**2**	**3**	**4**
(1) LF	1.15	5.00	3.77	.82	1.00			
(2) LTC	1.00	5.00	3.63	.91	.817**	1.00		
(3) IC	1.00	5.00	3.67	.86	.701**	.795**	1.00	
(4) OR	1.00	5.00	3.72	.84	.778**	.843**	.873**	1.00

**p<.01; N=310; (Note: LF: Leadership functions; LTC: Leadership team coherence; IC: Initiative climate; OR: Organizational resilience)

Leadership functions, leadership team coherence, climate of initiative, and organizational resilience had arithmetic means of 3.77 (SD=.82), 3.63 (SD=.91), 3.67 (SD=.86), and 3.72 (SD=.84), respectively, all of which were relatively high. Moreover, the variables were positively and significantly correlated. Leadership functions were positively correlated with leadership team coherence (r=.817; $p<.01$), climate of initiative (r=.701; $p<.01$), and organizational resilience (r=.778; $p<.01$). Leadership team coherence was positively correlated with climate of initiative (r=.795; $p<.01$) and organizational resilience (r=.843; $p<.01$). Lastly, climate of initiative was positively correlated with organizational resilience (r=.873; $p<.01$).

Findings on Structural Equation Modeling

Structural equation modeling was used to determine the mediating role of initiative climate on the relationship between distributed leadership (*leadership functions and leadership team coherence*) and organizational resilience. The fit indices of the model is as follows: x^2=2660.151; df= 697; p=.000; x^2/df=3.817; GFI=.703; CFI=.867; GFI: .703; RMSEA=.095. Table 3 presents the findings.

Table 3. Standardized Direct, Indirect and Total Effects

				Bootstrap 5000 times 95% CI			
Variables	**β**	**SE**	**t**	**Lower Bound**	**Upper Bound**	***p***	**Total Effect**
LF→OR **(H_1)**	.205	.072	4.071	-	-	.003	.323
LF→IC **(H_2)**	.189	.097	2.786	-	-	.036	.189
LTC→OR **(H_3)**	.282	.082	4.442	-	-	.002	.757
LTC→IC **(H4)**	.762	.056	10.186	-	-	.000	.762
IC→OR **(H_5)**	.624	.066	10.865	-	-	.000	.624
LF→IC→OR **(H_6)**	.118	.059	-	.011	.241	.032	.323
LTC→IC→OR **(H_7)**	.475	.069	-	.354	.629	.000	.757

(Note: LF: Leadership functions; LTC: Leadership team coherence; IC: Initiative climate; OR: Organizational resilience)

Leadership functions significantly predict organizational resilience (β=.205; p=.003) and initiative climate (β=.189; p=.036). Leadership team coherence significantly predicts organizational resilience (β=.282; p=.002) and initiative climate (β=.762; p=.000). On the other hand, initiative climate significantly predicts organizational resilience (β=.624; p=.000). Finally, initiative climate has a mediating role in the relationships between leadership functions and organizational resilience (β=.118; p=.032; 95% CI, LB=.011, UB=.241) and leadership team coherence and organizational resilience (β=.475; p=.000; 95% CI, LB=.354, UB=.629). The findings indicate that this is a complementary mediating role because both direct and indirect effects are significant (Zhao, Lynch & Chen, 2010) (Table 3). On the other hand, the effect sizes for indirect effects were calculated using the formula $ab/(ab+c^1)$ (Miočević, O'Rourke, MacKinnon & Brown, 2018). The findings showed that the effect size of the indirect effect of leadership functions on organizational resilience is .25 and it is .15 for the indirect effect of leadership team coherence on organizational resilience. These findings indicated that effect sizes of the indirect effects were medium level (Cohen, 1988). Figure 1 shows the structural relations between the variables.

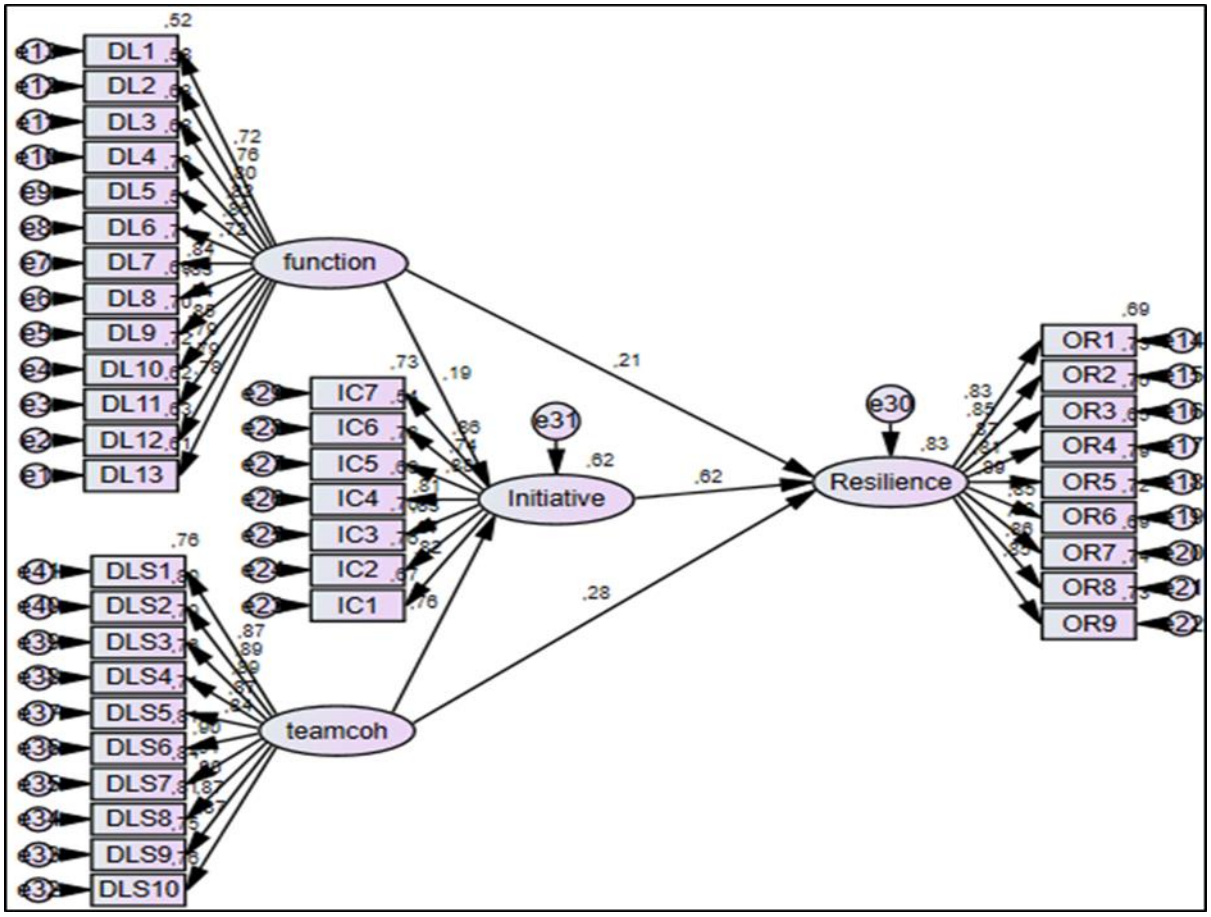

Figure 1. Structural Model

Discussion

This study investigated the mediating role of initiative climate on the relationship between distributed leadership and organizational resilience in schools. First of all, the level of organizational resilience, climate of initiative, and school principals' distributed leadership behaviors were revealed. The first variable was "distributed leadership," a leadership model that has been extensively studied in the field of education (Gümüş et al., 2018). Most participants *"agreed"* with school principals' distributed leadership behaviors, which is consistent with the previous literature (Arabacı, Karabatak & Polat, 2016; Ertürk & Sezgin-Nartgün, 2019; Korkmaz & Gündüz, 2011; O'Donovan, 2015). This finding has important implications because the primary goal of distributed leadership is to disseminate leadership throughout school staff and ensure that each school stakeholder acts as a leader based on their own expertise. Teachers to whom leadership is distributed are more likely to take more risks, face uncertainty more confidently, and pay more attention to the opinions of others. Distributed leadership also provides a powerful mechanism that paves the way for a positive pedagogical transformation (Clarkin-Phillips, 2009). However, distributed leadership in schools depends on organizational trust, supportive and facilitating management, and collaboration between teachers and administrators.

The second variable dealt with in this study was initiative climate. Initiative is a set of behaviors one displays, such as taking an active approach to achieving work goals and tasks and overcoming obstacles (Fay & Frese, 2001; Frese, 2001; Frese et al., 1997; Frese et al., 1996;). Most participants *"agreed"* with initiative climate in schools. Korumaz and Tufan (2020) also reported a similar result, whereas Sezgin-Nartgün and Taşkın (2017) reported that teachers neither agreed nor disagreed with a climate of initiative. Frese et al. (1997) and Frese and Fay (2001) found that employees took responsibility and initiative at a moderate level. We think that our result is important in school context because initiative climate increases the performance at both organizational and individual level (Lisbona et al., 2018; Taşkın, 2016). It can be said that this increase in performance significantly contributes to the school's ability to continue its education and training activities effectively, efficiently, and successfully.

The third variable was organizational resilience, which plays a key role, especially in times of change (Andersson et al., 2019; Coutu, 2002; Horne, 1997; Horne & Orr, 1998; Kantur & İşeri-Say, 2015; Linnenluecke, 2017; Somers, 2009). The participants *"agreed"* with organizational resilience capacity of their schools which is not consistent with previous literature (Sezen-Gültekin, 2019). We think that our result is important because resilience helps organizations face uncertainty (Sutcliffe & Vogus, 2003; Tengblad & Oudhuis, 2018; Vogus & Sutcliffe, 2007) and makes them more agile and robust (Kuntz et al., 2017). Resilience can be said to be the most important basis for today's organizations in managing the complexity, uncertainty, crises, overcoming pressures and gaining competitive edge (Sezen-Gültekin, 2019). In terms of educational organizations, the importance of organizational resilience becomes even more prominent. Educational organizations operate in an environment which is changing rapidly; so, they face unexpected situations very often. This make resilience a must for schools. Otherwise, they may have to endure undesirable outcomes.

On the other hand, we suggested that *school principals' distributed leadership behaviors (leadership functions and leadership team coherence) significantly predict initiative climate*. The findings confirmed that distributed leadership is a significant predictor of initiative climate. This is an important result because organizations with distributed leadership are likely to be more democratic, participatory, creative, and dynamic (Panahi, 2013), which can encourage employees to take more initiative. At least in scope of this study, we could not reach a study analyzing the relationship between distributed leadership and initiative climate. In this sense, it can be said that we contributed distributed leadership literature with a different perspective. However, distributed leadership makes teachers more eager to gain professional knowledge (Bektaş, Kılınç & Gümüş, 2020) and more satisfied with their job (Liu, Bellibaş & Gümüş, 2020; Sun & Xia, 2018; Torres, 2019). It increases organizational commitment (Uslu & Beycioğlu, 2013) and it is positively associated with value-based leadership (Baloğlu, 2012). School principals distributing leadership can foster trust and respect among teachers (Bellibaş & Liu, 2016), encouraging them to take more initiative.

We also suggested that *school principals' distributed leadership behaviors significantly predict organizational resilience.* The results showed that leadership functions and leadership team coherence predicted organizational resilience. Distributed leadership, an alternative to leader-centered traditional leadership models, assumes that leadership is not a personal but a shared trait (Bolden, Petrov & Gosling, 2008). In other words, one's performance is not superior to others' in distributed leadership (Gronn, 2002). Distributed leadership improves organizational resilience, enabling organizations to proactively cope with complex situations and uncertainty (Tengblad & Oudhuis, 2018) because leadership qualities manifest themselves in organizational resilience (Nilakant et al., 2014). When the leadership is distributed, school organizations can exploit the expertise of all shareholders which can contribute to resilience. Because through distribution of leadership an environment in which teachers can work individually and collectively to overcome challenges is created.

Another suggestion of the current study was that *initiative climate significantly predicts organizational resilience*, which was confirmed by the results. Initiative involves standing out among other organizations, anticipating, and solving problems, and seeking ways to draw up long-term plans and execute them (Campos, Frese, Goldstein, Iacovone, Johnson, McKenzie & Mensmann, 2017), making organizations more flexible and agile in the face of uncertainty (Lengnick-Hall et al., 2011). In schools where initiative climate is high, teachers act immediately, and they exert extra effort to deal with crisis situations and challenges which can make schools more resilient.

Finally we suggested that *initiative climate plays a mediating role in the relationship between organizational resilience and school principals' distributed leadership behaviors*. The results indicate that initiative climate plays a mediating role. In other words, distributed leadership promotes initiative climate which in turn contributes to organizational resilience in schools. Distributed leadership is associated with organizational resilience, which involves standing fast against shocks and coping with adversaries (Vogus & Sutcliffe, 2007). Resilient and agile organizations with risk awareness and collaboration, and improvisation (Andersson et al., 2019) are better at recovering from external shocks (Jung, 2017). School principals interested in increasing organizational resilience should promote distributed leadership and professional development (activities, courses, seminars, etc.). What is more, leaders should be financially supported, and decisions should be jointly made. Creating a climate of initiative, which plays a mediating role between organizational resilience and distributed leadership, is becoming more and more critical in the 21st century (Frese & Fay, 2001) because initiative helps improve in-role performance and resolve organizational conflicts (Fay & Sonnentag, 2002; Fay, Sonnentag & Frese, 1998). Therefore, employees should be rewarded and provided with support, guidance, and time and space to take initiative. It is believed that school principals' leadership behaviors can improve organizational resilience.

Conclusion and Suggestions

This study aimed to reveal the relationships among principals' distributed leadership, initiative climate and organizational resilience of schools. Our data indicate that distributed leadership has the potential to foster initiative climate and organizational resilience. On the other hand, schools where teachers take initiative can be more resilient. Lastly, our data suggested that distributed leadership has a positive effect on schools' resilience through initiative climate. This study implies that to boost initiative and resilience in schools, principals should assign leadership roles to teachers.

We found that both direct and indirect effects of distributed leadership on organizational resilience are significant indicating complementary mediation as stated above which means the likelihood of omitted mediators in our model (Zhao et. al. 2010). Therefore, future research should be carried out incorporating additional variables in the model both as mediators and moderators. In this way, a better insight into schools' resilience can be provided.

Based on the findings it can be recommended that distributed leadership be the leadership of choice in schools. Moreover, teachers should be encouraged to take more initiative, and successful ones should be rewarded to make schools more resilient.

Limitations

The findings of the study are not without limitations. Firstly, the assessment was based on only teachers' perceptions. Further studies should include other stakeholders' views. Secondly, participants were recruited using convenience sampling, but the study did not aim to generalize its results to a larger population so it could be regarded as a suitable sampling method. This is a cross-sectional study which cannot give cause-effect relationships. Researchers can carry out longitudinal studies to reveal cause-effect relationships among these variables.

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International Journal of Contemporary Educational Research (IJCER)

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To cite this article:

Özhan, M. B., & Yüksel, G. (2021). The effect of school burnout on academic achievement and well-being in high school students: A holistic model proposal. *International Journal of Contemporary Educational Research*, *8*(1), 145-162. DOI: https://doi.org/10.33200/ijcer.824488

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International Journal of Contemporary Educational Research
Volume 8, Number 1, March 2021, 145-162 ISSN: 2148-3868

The Effect of School Burnout on Academic Achievement and Well-Being in High School Students: A Holistic Model Proposal**

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Abstract

This study aimed to contribute to a holistic analysis of the effect of school burnout on academic achievement and well-being in high school students. For this purpose, a structural equation model made up of variables, including self-regulation, student-teacher relationships, peer relationships, family involvement to school, school burnout, academic achievement, and well-being, was tested. The sample of study consisted of 866 high school students from seven different types of high schools. The data of study were collected using a set of eight scales consisting of the Personal Information Form, Self-Regulation Scale, the Friendship Qualities Scale, the Self-Determination Theory-Based Student-Teacher Relationship Questionnaire-High School Form, the Perceived Parental and Teacher Academic Involvement Scale, the Maslach Burnout Inventory-Student Survey, the Academic Achievement (GPA), and the EPOCH Measure of Well-Being (EPOCH). Total six hypotheses were tested with the hypothetical model established within the scope of the study. As a result of the analysis, it was found that all of the hypotheses regarding the proposed hypothetical model were accepted, and the model was confirmed. The findings of the study revealed that each of the variables, namely, self-regulation, student-teacher relationships, peer relationships, and family involvement to school, had a direct and negative predictor effect on school burnout.

Key words: High school students, school burnout, academic achievement, well-being, structural equation modeling

Introduction

School is an important institution that provides children with cognitive, affective, behavioral, and social development opportunities and equips them with the necessary qualifications to take part in social and business life (Aypay, 2017; Yıldız and Kılıç, 2020). Considering also pre-school educational institutions, it can be said that school is an important social environment where individuals spend a large part of the day starting from an early age. During this time spent at school, individuals have the opportunity to experience a wide variety of life events for the first time. In other words, schools, which are a special environment created for children and young people to prepare for the adult world (Öğülmüş, 2006), provide students with an important developmental context (Eccles, 2004). However, in addition to this developmental opportunity they provide to students, schools are also an important environment where not only the desired outcomes that are consistent with the educational goals emerge, but also different and not-always-positive feelings, emotions, and problems arise and develop (Pilkauskaite-Valickiene, Zukauskiene, and Raiziene, 2011). At this point, it can be said that school life and experiences have the potential to affect many important outcomes of the individual in both academic and social and emotional areas, depending on the quality of these experiences and life events. One of the main academic outcomes for students is academic achievement (Lunenburg and Ornstein, 2013; Sezgin, 2013), and the other is well-being, which is an important outcome in social and emotional areas. Many factors that are directly or indirectly related to students' academic achievement and well-being are defined in the literature. One of the

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** This article is based on the first author's doctoral thesis titled *"Investigation of The Effect of School Burnout on Academic Achievement And Well-Being with A Holıstıc Approach in High School Students"* prepared under the supervision of the second author.

factors that have the potential to affect students' academic achievement (Atik and Özer, 2020; Balkıs, Duru, Buluş, and Duru, 2011; Tuominen-Soini and Salmela-Aro, 2014; Madigan and Curran, 2020; Çelik ve Pesen,2020) and well-being (Aypay and Eryılmaz, 2011; Parker and Salmela-Aro, 2011; Fiorilli, De Stasio, Di Chiacchio, Pepe, and Salmela-Aro, 2017; Salmela-Aro, Savolainen, and Holopainen, 2009; Tang, Upadyaya, Salmela-Aro, 2021) is stated to be school burnout.

The Holistic Conceptualization of School Burnout and It's Relation to Academic Success and Well-being

The concept of school burnout, which is used to explain the phenomenon of burnout that students experience with their school life, consists of three dimensions, namely, exhaustion at school, cynicism, and a sense of inadequacy at school (Bask and Salmela-Aro, 2013; Luo et al., 2016; May et al., 2015; Walburg, 2014). Exhaustion at school refers to burnout felt towards school and school-related work, cynicism refers to the belief that the school is not necessary or will not benefit, and inadequacy at school refers to students' thoughts that they will not be able to achieve the tasks required by school (Salmela-Aro, Kiuru, Leskinen, and Nurmi, 2009).

According to Hobfoll and Shirom (2001) and Brake, Eijkman, Hoogstraten, and Gorter (2005), burnout is not a phenomenon that occurs suddenly in the individual, but a condition that occurs as a result of the interaction of many factors cumulatively. Accordingly, the phenomenon of school burnout seen in students can be evaluated as a condition that occurs cumulatively in the developmental process with the effect of many factors, too. At this point, the theoretical orientation, which was raised by Bronfenbrenner in the 1970s (TEDMEM, 2014), provides an important perspective to describe the basic factors influencing human development (Bronfenbrenner and Morris, 2006). This theory draws attention to the interaction of the student with themselves and their environment, the effect of the environment on the development of the individual, and furthermore, many close and distant systems that affect the individual's environment to understand the behaviors of the individual and the development process. From this perspective, it is possible to conceptualize many individual characteristics and environmental systems that have the potential to affect school burnout and are the focus of this research.

Bronfenbrenner locates the individual at the center of all systems in his ecological theory, and names this system, which is at the center, as "organism (individual)". According to the ecological theory, many characteristics of the organism that can be evaluated within the system of the individual affect the development, behaviors, and many emotional, personal, and social outcomes of individuals. At this point, it can be said that one of the important individual characteristics that can have an effect on the school burnout that students experience is self-regulation skill. Self-regulation skill in the most general sense can be conceptualized as the observation of one's own behaviors, making judgments by comparing these behaviors with their own criteria, and adapting these behaviors to their own criteria when they are not compatible with these criteria. In other words, self-regulation skill refers to individuals' capacity to influence, direct, and control their own behavior (Senemoğlu, 2009). Acording to Bandura (1977), individuals regulate their behavior to a great extent, and in this context, if the performance standards set by the individual are too high for the individual to reach, this will turn into a source of unhappiness for the individual. On the other hand, when individuals see that they cannot reach their performance standards during self-evaluation, this leads the individual to feel increasingly worthless and experience a lack of purpose in life and negative situations such as depressive reactions. Setting goals that are too difficult and remote for the individual to reach may likewise disappoint individuals (Senemoğlu, 2009). Consistent with Bandura's theoretical explanations about self-regulation, the phenomenon of school burnout is also considered to be positively associated with high personal expectations, low control level, and low motivation (Duru, Duru and Balkıs, 2014). When all these are evaluated together, it can be said that the self-regulation skills of students have the potential to affect school burnout, which is the focus of this study, and academic achievement and well-being depending on school burnout.

In the ecological theory, environmental factors as well as individual characteristics are effective in the development process of the individual. Accordingly, it can be said that school burnout is not only and directly limited to the qualifications of the student. As stated by Kutsal and Bilge (2012), in addition to students' own factors, strengths, and wishes, a balance of the expectations from the student by their family, friends and teachers, as well as the support and guidance of their immediate circles, are significantly effective in the occurrence of burnout in the student. Consistent with this perspective, various studies in the literature (Halbesleben, 2006) also reveal that the support provided by peers and teachers, who are important social actors in the close environment of the individual, is associated with the burnout in the context of the school ecosystem. Accordingly, the social support provided to students by their teachers and friends and the positive quality of the communication and interaction that individuals have with their teachers and friends reduce the burnout experienced by individuals. For example, Salmela-Aro, Tynkkynen, and Vuori (2011) revealed that social context played an important role in the burnout experienced by the student. At this point, in addition to self-

regulation, which is one of the personal characteristics directly related to the student, the roles of important social actors with whom the student directly interacts in school burnout are considered to be important factors worth investigating. Accordingly, considering the school ecosystem, it can be said that the two important actors with whom the student interacts directly and intensely are teachers and peers. For this reason, it can be said that *(i)* the relationship and interaction between student and teacher and *(ii)* the relationship and interaction the student establishes with peers are significant variables that may have the potential to affect school burnout and students' academic achievement and well-being depending on school burnout.

According to the ecological theory, the environmental systems close to the individual and also the connections and interactions between systems affect the development process of the individual. This situation is expressed in the ecological theory as the meso-system step. The meso-system involves the interaction between two or more micro-systems that the individual has a direct relationship and interaction with (TEDMEM, 2014). At this point, the relationship between family and school micro systems, with which high school adolescents have a direct and one-on-one communication throughout their developmental process, can be considered as an important variable related to the meso-system level. The relationship between family and school systems, which are two micro-systems that play an important role in individuals' lives in the developmental process, can be considered as family involvement to school. In the most general terms, family involvement to school includes the involvement and monitoring of the student's parents in academic life in school (Dündar, 2014). Various studies in the literature have stated that family involvement to school plays an important role in increasing students' academic achievement and learning motivation, and supporting school engagement and class participation, developing a positive attitude towards school, and reducing absenteeism and discipline problems (Castro et al., 2015; Jeynes, 2003, 2005, 2007; Kim and Hill, 2015; Zorbaz, 2018). From this point of view, it can be said that family involvement to school is an important variable that is potentially effective in primarily reducing the level of burnout experienced by students and also increasing academic achievement and well-being.

Context and Hypotheses of the Research

In this study, it is thought that examining the relationship between the student himself (organism) and other factors directly related to the educational process (environmental systems) with school burnout is important in understanding school burnout in a holistic way. Moreover, the study examining the effects of school burnout on the well-being and academic achievement of students together with other factors related to the educational process, which is directly related to school burnout, is expected to contribute to the reduction of school burnout and thus to provide a basis for studies aimed at increasing academic success and well-being. At this point, in this research with the support of ecological theory proposals, investigating the phenomenon of school burnout experienced by high school students and the effect of this phenomenon on academic achievement and well-being holistically in the context of the school ecosystem made up the main problem of this research. Accordingly, this study tested a structural equation model which was created based on the literature and included variables, such as self-regulation, student-teacher relationships, peer relationships, family involvement to school, school burnout, academic achievement, and well-being. Hence, the hypotheses related to the model tested within the scope of the study and the major studies in the literature used to form the basis for these hypotheses can be listed as follows:

H1: *Self-regulation is a negative and significant predictor of school burnout* (Kapıkıran et al., 2016; Duru et al., 2014; Schaufeli et al., 2002a).
H2: *Peer relationships are a negative and significant predictor of school burnout* (Zhang & Zhu, 2007; Kutlu and Bilge, 2012; Walburg, 2014).
H3: *Student-teacher relationships are a negative and significant predictor of school burnout* (Shih 2012, 2015; Aypay, 2012; Çam and Öğülmüş, 2021).
H4: *Family involvement to school is a negative and significant predictor of school burnout* (Gonzalez-DeHass, Willems, and Holbein, 2005; Alarcon, Edwards, and Menke, 2011; Durmuş, Aypay, and Aybek, 2017).
H5: *School burnout is a negative and significant predictor of academic achievement* (Seibert, Bauer, May, and Fincham, 2017; Lee et al., 2010; Salmela-Aro et al., 2008).
H6: *School burnout is a negative and significant predictor of well-being* (Cadime et al., 2016; Murdock, 2013; Aypay and Eryılmaz, 2011).

Method

Research Model

In this study, the relationships between self-regulation, student-teacher relationships, peer relationships, family involvement to school, school burnout, academic achievement, and well-being in high school students were analyzed. In this respect, the study used a correlational research design. Correlational studies are conducted to explain the relationship between two or more variables and to make inferences about the cause-effect relationships between these variables (Fraenkel, Wallen, and Hyun, 2012). The structural equation modeling was used as a data analysis method in examining the relationships between variables within the scope of the study (Kline, 2011). The structural equation modeling is a technique that helps examine the causal relationships between many variables related to the structure simultaneously, moreover, clarifies whether the expected relationships of the studied structure are observed in terms of the theory on which it is based (Tavşancıl, 2014).

Population and sampling

The population of the study consisted of students attending public high schools in Yakutiye, Palandöken, and Aziziye districts, which are the central districts of Erzurum province, in the 2018-2019 academic year. The sample of the study, on the other hand, was determined using the stratified random sampling method from the schools in the population. In determining the sample group of the study, the school type was accepted as the main strata. The research was ultimately carried out with 10th and 11th -grade high school students from 7 different school types. These two qualifications arising from the classification of the sample group of the study regarding the school types and grade levels were considered as a limitation of the study.

While calculating the sample size required for testing the model established within the scope of the research, Kline's (2011) suggestion that the sample size in structural equation modeling studies should ideally be 20 times, at least 10 times, the number of parameters was taken into consideration. There were a total of 62 parameters in the final model of the research (Figure 1). Accordingly, considering that a sample size of at least 620 [62 x 10] was needed to properly test a model with 62 parameters, the scale was administered to a total of 1008 students from 18 different schools by taking erroneous, incomplete data and extreme values into account. As presented under the process and data analysis section in detail, the scales belonging to 142 students were removed from the data set of the study, and the data obtained from 866 students formed the final data set. Considering the suggestion of Kline (2011), the eventual sample size of the study was satisfactory.

Table 1. The distribution of the sample group by school type

School type	**Population**		**Sample**	
	N	**%**	**N**	**%**
Anatolian High School	5280	46.55	385	44.5
Science High School	518	4.57	42	4.8
Social Sciences High School	420	3.70	38	4.4
Fine Arts High School	109	0.96	18	2.1
Sports High School	199	1.75	22	2.5
Vocational High School	2655	23.41	189	21.8
Imam Hatip High School	2161	19.05	172	19.9
Total	**11342**	**100**	**866**	**100**

Table 1 presents a comparative distribution of the students in the sample group of the study by school types and the population and the sample. The examination of the distribution of high school students in the sample group presented in Table 1 according to the type of school indicated that different school types were represented in the sample group at a rate close to their rate in the population (with a maximum deviation of 2 %). Moreover, 530 of the high school students constituting the sample group of the study were 10th-grade students (61.2%), and the remaining 336 were 11th-grade students (38.8%). The sample group of the study consisted of 440 female

(50.8%) and 402 male (46.4%) high school students. Besides, 24 (2.8%) students in the sample group of the study had not stated their gender. The ages of the students in the sample varied between 14 and 18, and the mean age was 16.29 years.

Data collection tools

In this study, a scale set consisting of eight parts was used to collect data. Information on each scale is presented in order below.

The Personal Information Form (PIQ): This form was developed to collect information about the demographic characteristics of the high school students participating in the study. The form contains a total of 4 questions regarding the type of school that the students attend, their sex, age, and grade levels.

The Self-Regulation Questionnaire (SRS): The original form of this scale was created by Brown, Miller, and Lawendowski (1999), and the short form was developed by Carey et al. (2004). The Turkish adaptation study of the scale was carried out over the short form by Ay (2014) within the scope of the doctoral dissertation study conducted on university students, and the scale was found to be valid and reliable. The SRS, which consists of 5 sub-dimensions, namely, receiving information, focusing on alternatives, formulating a plan, implementing the plan, and assessing the plan, and a total of 30 items, was used in a sample group in the present study that was different from that of the adaptation study in terms of development level; therefore, the validity of the scale in this study was re-analyzed with confirmatory factor analysis, and its reliability was re-evaluated by calculating Cronbach's Alpha internal consistency coefficient. Accordingly, the SRS was determined to be valid for the data obtained from the sample of the present study [χ^2 / df = 3.29; GFI = ,91; AGFI = ,88; CFI = ,91; RMSEA = .065]. Besides, Cronbach's Alpha internal consistency coefficient regarding the reliability of the SRS in this research sample was calculated as α = .87.

The Friendship Qualities Scale (FQS): The original form of this scale, consisting of 23 items and 5 sub-dimensions, was developed by Bukowski et al. (1994), and the Turkish adaptation study of the scale was carried out by Erkan-Atik et al. (2014). The Turkish form of the scale, adapted within the scope of a project carried out on secondary school students, consists of a total of 22 items and 5 sub-dimensions, namely, companionship, conflict, help, security, and closeness. The reliability of the scale was re-analyzed since the FQS was re-used in a sample group in this study different from that of the adaptation study. Cronbach's Alpha internal consistency coefficient regarding the reliability of the FQS in this study sample was calculated as α = .88.

The Self-Determination Theory-Based Student-Teacher Relationship Questionnaire-High School Form (SD-STRQ): Developed by Özhan (2019) based on the Self-Determination Theory to learn about the quality of the relationship that high school students establish with their teachers, the SD-STRQ consists of 15 items and three sub-dimensions, namely, autonomy, competence and relatedness. Since the SD-STRQ was re-used in a different sample group in this study, the reliability of the scale was re-analyzed. Cronbach's Alpha internal consistency coefficient regarding the reliability of the SD-STRQ in the present study sample was calculated as α = .94.

The Perceived Parental and Teacher Academic Involvement Scale (PPTAIS): The original form of this scale was developed by Rêgner, Loose, and Dumas (2009), and it was adapted into Turkish by Dündar (2014). The validity of the scale in the Turkish adaptation study was examined separately in two different sample groups consisting of 302 primary-secondary school and 393 high school students. The PPTAIS, which consists of 16 items and 4 sub-factors, namely, perceived parental academic monitoring, perceived parental academic support, perceived teacher academic monitoring, and perceived teacher academic support, was used to measure family involvement to school in this study. For this reason, only the two sub-dimensions of the PPTAIS, namely, perceived parental academic monitoring and perceived parental academic support, which measure parental academic involvement, were combined and used under a latent variable named family involvement. Since the PPTAIS was re-used in a sample group in this study different from that of the adaptation study by combining only the items related to parental involvement under the family involvement variable, the reliability of the scale was re-analyzed within the scope of this study. Cronbach's Alpha internal consistency coefficient regarding the reliability of the PPTAIS in this study sample was calculated as α = .86.

The Maslach Burnout Inventory-Student Survey (MBI-SS): The original form of this inventory was developed by Maslach, and its adaptation study was carried out by Schaufeli et al. (2002b) on university students. The scale consists of 15 items under three sub-factors called exhaustion, cynicism, and efficacy. The Turkish adaptation of the inventory for high school students was carried out by Kutsal (2009), and with this study, the scale was concluded to consist of 3 sub-dimensions called exhaustion (5 items), cynicism (4 items) and self-efficacy (6 items) and 15 items. Since the MBI-SS was re-used in a different sample group in this study, the reliability of the scale was re-analyzed in the present study. Cronbach's Alpha internal consistency coefficient regarding the reliability of the MBI-SS in this study sample was calculated as $\alpha = .89$.

The Academic Achievement (GPA): The academic achievements of the students participating in the study were measured based on the weighted final grade averages for the fall semester of the 2018-2019 academic year. Final grade point averages were assumed to be valid and reliable in measuring academic achievement.

The EPOCH Measure of Well-Being (EPOCH): Based on the PERMA theory proposed by Seligman (2011), the scale aims to measure well-being in a holistic way. PERMA stands for the acronym created based on the initials of the components in the multidimensional structure of well-being. In this acronym, P represents positive emotions; E, engagement; R, positive relationships; M, meaning; and A, achievement/accomplishment. This conceptualization proposed by Seligman (2011) regarding this holistic structure of well-being is considered as rather a suitable structure for adults. Therefore, Kern et al. (2016) adapted the PERMA model for adolescents to measure the well-being levels of adolescents holistically. As a result of this adaptation, the dimensions of well-being were named as E: Engagement, P: Perseverance, O: optimism, C: Connectedness, and H: happiness, and were expressed with the acronym EPOCH, which consists of the initials of these dimensions. The EPOCH Scale, which was found to be valid and reliable in the adaptation study conducted by Demirci and Ekşi (2015), was re-used in a sample group in this study different from that of the adaptation study; therefore, the reliability of the scale was re-analyzed within the scope of this study. Cronbach's Alpha internal consistency coefficient regarding the reliability of EPOCH in this study sample was calculated as $\alpha = .88$.

The process and data analysis

The set of scales used to collect the research data was administered face-to-face by the researcher in the classroom and as a paper-pencil test. Due to the large number of items on the scale set administered in the study, the scale set was applied in two steps as part I and part II. In the scale set used in the study, students were asked to use a nickname (code name) so that the first and second parts of the scale could be matched. During the administration of the first part of the scale set, the students were asked to determine a nickname (code name) and to write this code in the place specified in the form. To prevent students from forgetting their nicknames, the first and second parts of the scale set were administered with a minimum of one lesson and a maximum of one-day interval so that the education in the school would not be interrupted. At this point, 82 students who did not complete the first part of the data collection phase of the research but did not complete the second part were excluded from the sample group of the study.

The analysis of the data was carried out in two stages, namely the "preliminary analysis", which was carried out to examine whether the model established was suitable for structural equation analysis, and "the analysis of the model", which included the testing of the model. In the "preliminary analysis" stage, firstly, missing data, extreme values, and normality of the distribution were examined. Then, after determining that the presence of significant relationships between variables and that this was not due to multicollinearity, the analysis phase of the model was initiated. In the analysis phase of the model, the two-stage approach suggested by Anderson and Gerbing (1988) and Kline (2011) was adopted. In this context, firstly, the measurement model established based on the research variables and then the structural model were tested. In the evaluation of the model fit, goodness of fit indices, including χ^2 (Chi-Square), df (degrees of freedom), χ^2 / df, GFI, AGFI, CFI, RMSEA, and SRMR, were taken into consideration. In addition to all these, two different statistical software packages were employed in the analysis of the data. The basic statistics [frequency, percentage, mean, standard deviation, kurtosis and skewness, and reliability analysis based on correlation and internal consistency (α)] were carried out on IBM SPSS 22, and the test of the structural equation model was performed on IBM AMOS Graphics software package.

In the analysis of the data, first, the missing data in the data set were examined. The rate of acceptable unanswered items was determined as 5% as a criterion for the analysis and evaluation of the missing data (Tabachnick and Fidell, 2013). Accordingly, scale sets of 33 students containing more than 5% unanswered items were removed from the general data set. Also, the missing data on scales with less than the acceptable limit of 5% unanswered items were made up based on the arithmetic average. After examining the missing data, the data set was examined in terms of extreme values to avoid problems caused by extreme values in the analysis of the data. Univariate extreme values in the data set were analyzed using histogram graphs, box graphs, and calculated z scores on the IBM SPSS software package. The multivariate extreme values deviating from the normal distribution were analyzed by calculating the Mahalobonis distance coefficients. Accordingly, scale sets of 27 students that were determined to have extreme values were excluded from the data set of the study.

After the univariate and multivariate extreme values in the data set had been analyzed, the kurtosis and skewness coefficients regarding whether the variables in the study showed normal distribution were examined. In the evaluation of kurtosis and skewness coefficients, especially in studies conducted with large samples, it has been stated that the location of these coefficients in the range of ± 2 is satisfactory for the distribution to be considered normal (Tabachnick and Fidell, 2013). Accordingly, it was observed that the kurtosis and skewness coefficient values of the research variables provided the necessary criteria for the acceptance of the normal distribution of the data for both the latent variables (total scores) of the research and the observed variables (sub-dimensions). After determining that the variables in the study showed a normal distribution, the Maximum Likelihood method was chosen as the estimation method for testing the structural equation model (Kline, 2011).

Results and Discussion

First, the descriptive analyses of the variables included in the model were performed, and then the findings regarding the correlations between variables were revealed through correlation analysis. Table 2 presents the results of the descriptive analysis of the variables in the model and correlation coefficients between variables.

Table 2. Results of the descriptive analyses and correlation coefficients between variables

Variable	$\bar{X}$	**Ss**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1. Self-Regulation	109.74	15.03	1	.21*	.19*	.27*	-.42*	.13*	.47*
2. Student-Teacher Relationships	46.93	13.75		1	.29*	.29*	-.52*	.38*	.38*
3. Peer Relationships	78.79	14.27			1	.25*	-.25*	.17*	.35*
4. Family Involvement to School	30.92	6.22				1	-.37*	.12*	.44*
5. School Burnout	42.38	16.20					1	-.37*	-.55*
6. Academic Achievement	75.68	11.90						1	.23*
7. Well-Being	67.06	12.83							1

* $p < .001$

As seen in Table 2, there were significant correlations between all the variables in the structural equation model established within the scope of the study, namely, self-regulation, student-teacher relationships, peer relationships, family involvement to school, school burnout, academic achievement, and well-being. Accordingly, there was a moderate and significant negative correlation between school burnout scores, which is one of the basic dependent/independent variables of the research, and the scores of self-regulation ($r = -.42$; $p < .001$), student-teacher relationships ($r = -.52$; $p < .001$), and family involvement to school ($r = -.37$; $p < .001$), and a low level, significant negative correlation with the score of peer relationships ($r = -.25$; $p < .001$). Besides, a moderate and significant negative correlation was found between the school burnout scores of the students participating in the study and their academic achievement ($r = -.37$; $p < .001$) and well-being ($r = -.55$; $p < .001$) scores. In the evaluation of the correlations between variables in the model, the correlations were evaluated in accordance with the criteria suggested by Cronk (2008), based on an absolute value as follows: .30 or less as low correlation; between .30 and .70 as moderate; values greater than .70 as high.

Testing of the Measurement Model

In the analysis of the structural equation model established within the scope of the research, first, the measurement model was tested, as detailed under the data analysis title. The established measurement model was first tested without any modifications. The results of the analysis showed that the measurement model established did not comply with the data set, especially in terms of some criteria [χ^2 / df = 4.845; GFI = .896; AGFI = .866; CFI = .904; RMSEA = .067; SRMR = .066]. Subsequently, the proposed modifications of the model were examined, and in line with these suggestions and the theoretical basis stated in the literature, a total of two modifications, including the first between "exhaustion" and "cynicism" items (MI = 42.592) and the second between "optimism" and "happiness" items (MI = 42.675), were administered to the related items by drawing and correlating the bidirectional covariance path of errors of the related items. After these modifications applied, it was observed that the model provided the necessary goodness of fit criteria, in other words, the established model and the data fitted adequately, and the established measurement model was confirmed [χ^2 (N = 866) = 906.398; p < .001; df = 230; χ^2/df = 3.941; GFI = .914; AGFI = .888; CFI = .927; RMSEA = .058; SRMR = .0568].

There was no statistically insignificant path in the measurement model tested. Also, observed variables in the model were found to do enough loading to the measurement model they were related to. In other words, the findings related to the measurement model showed that the observed variables of the study described the latent variables validly. After the measurement model was tested and confirmed, the structural model established in line with the research hypotheses was tested.

Testing of the Structural Model

In this study, which aimed to analyze the effect of school burnout on academic achievement and well-being, first, the structural model established in line with the research hypotheses was tested without applying any modifications. The results of the analysis showed that the structural model established did not fit the data set in terms of some criteria [χ^2/df = 5.277; GFI = .882; AGFI = .853; CFI = .889; RMSEA = .070; SRMR = .071]. Therefore, some solutions were tested to strengthen the fit of the structural model established with the data set.

Accordingly, first, the proposed modifications were examined, and the theoretical and statistical appropriateness of these proposed modifications was evaluated. Among these proposed modifications, the recommended modification (MI = 166.634) between the error terms for "cynicism" and "exhaustion" variables was noteworthy. When the variables observed to be related with the errors were examined, the emotional exhaustion experienced by the student due to school activities and school life and cynicism were evaluated as processes that could be theoretically related to each other. Statistically, the proposed modification index value was quite high (the highest modification index among the proposed ones), it was considered to make a significant contribution to the chi-square (χ^2) value of the model to increase the model fit, and the proposed modification was among the observed variables of the same latent variable. For these reasons, we decided to take this proposal into consideration and to perform the modification, and to retest the model. Thus, the bidirectional covariance path for these two error terms represented by e16 and e17 was drawn and correlated, and then the model was retested. After the application of this modification, it was observed that the model met the necessary goodness of fit criteria, in other words, the model and the data fitted satisfactorily, and the established structural model was confirmed [χ^2 (N = 866) = 1069.099; p < .001; df = 240; χ^2/df = 4.455; GFI = .900; AGFI = .875; CFI = .911; RMSEA = .063; SRMR = .0655]. Accordingly, this structural model, which was tested after the modification and included in Figure 1, was determined as the ultimate structural model of the research, and the research hypotheses were evaluated based on this model.

After examining the outputs of the structural model established in line with the hypotheses of the research and deciding that the model was confirmed, the paths in the model and the parameter estimates related to the model were also analyzed. The parameter estimates including the non-standardized regression coefficients and standard errors, standardized regression coefficients, critical ratios (Critical Ratio: Cr), and significance values of the paths in the model are presented in Table 3.

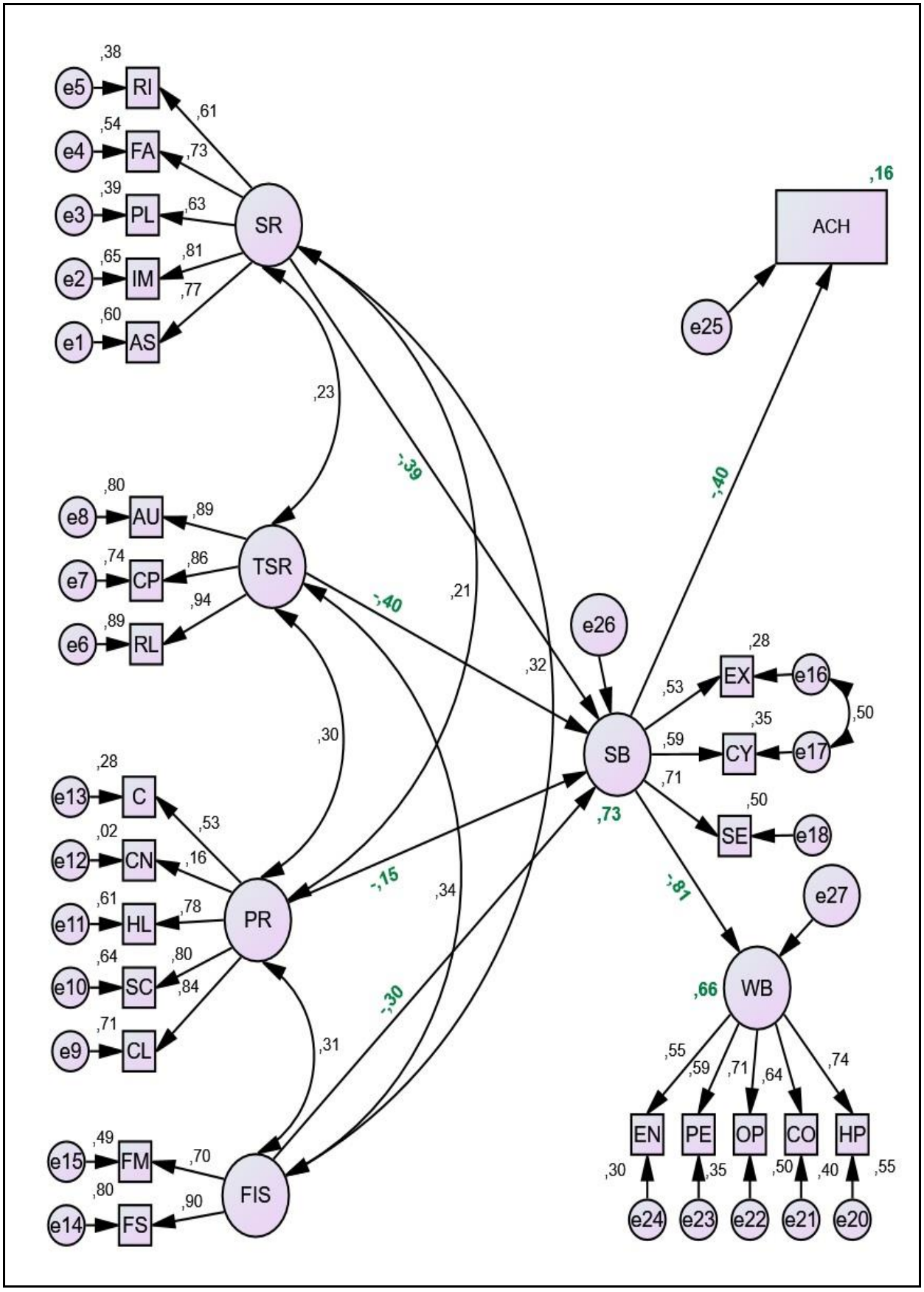

Figure 1. The structural model that was tested (the final version)

Table 3. Parameter estimates of the structural model tested (the final version)

Variables	Unstandardized Coefficients		Standardized Coefficients	C.R.	p
	B	S. E.	β		
SB <--- SR	-.46	.05	-.39	-9.56	***
SB <--- TSR	-.31	.03	-.40	-10.02	***
SB <--- PR	-.13	.03	-.15	-4.24	***
SB <--- FIS	-.36	.05	-.30	-6.86	***
ACH <--- SB	-1.29	.14	-.40	-9.49	***
WB <--- SB	-.65	.05	-.82	-12.99	***
Receiving information <--- SR	.70	.04	.61	17.41	***
Focusing on alternatives <--- SR	.61	.03	.74	21.06	***
Planning <--- SR	.86	.05	.63	17.76	***
Implementing<--- SR	1.22	.05	.81	23.00	***
Assessment<--- SR	1.00	---	.78	---	
Autonomy <--- TSR	.91	.02	.89	41.89	***
Competence <--- TSR	.88	.02	.86	38.67	***
Relatedness<--- TSR	1.00	---	.94	---	
Companionship <--- PR	.43	.03	.53	15.51	***
Conflict <--- PR	.13	.03	.16	4.29	***
Help <--- PR	.89	.04	.78	24.15	***
Security<--- PR	.77	.03	.80	24.65	***
Closeness<--- PR	1.00	---	.84	---	
Family monitoring <--- FIS	.81	.06	.70	14.01	***
Family support<--- FIS	1.00	---	.90	---	
Exhaustion<--- SB	1.00	---	.53	---	
Cynicism<--- SB	1.03	.06	.59	17.86	***
Self-efficacy<--- SB	1.30	.09	.71	13.94	***
Engagement <--- WB	.64	.04	.55	14.73	***
Perseverance <--- WB	.63	.04	.59	15.82	***
Optimism <--- WB	.87	.05	.71	18.69	***
Connectedness <--- WB	.79	.05	.64	16.92	***
Happiness <--- WB	1.00	---	.74	---	

*** $p < .001$

As seen in Table 3, all the paths that indicated predictive causal relationships between the research variables in the model were meaningful. According to this model, each of the variables, namely, self-regulation (β = -.39; Cr = -9.56; p <.001), student-teacher relationships (β = -.40; Cr = -10.02; p <.001), peer relationships (β = -.15; Cr = -4.24; p < .001) and family involvement to school (β = -.30; Cr = -6.86; p < .001) had a direct and negative predictor effect on school burnout. The relative importance rank of the predictor effects of the variables included student-teacher relationships (β = -.40), self-regulation (β = -.39), family involvement to school (β = -.30) and peer relationships (β = -.15). These four predictor variables (self-regulation, student-teacher relationships, peer relationships and family involvement to school) explained 73 % of the total variance regarding school burnout ($R^2 = .73$).

Besides, according to the final model, school burnout, which is both the dependent and independent variable of the study, had a direct and negative predictive effect on both academic achievement (β = -.40; Cr = -9.49; p < .001) and well-being (β = -.82; Cr = -12.99; p < .001). Also, school burnout explained 16% (R^2 = .16) of the total variance regarding academic achievement and 66% (R^2 = .66) of the total variance relating to well-being. Another important finding here was that the predictive effect of school burnout on well-being (β = -.82) was relatively higher than its predictive effect on academic achievement (β = -.40). In addition to all of these, the total, direct, and indirect effects of the variables in the model on each other were also examined. Table 4 presents the total, direct, and indirect effects.

Table 4. Total, direct, and indirect effects of the variables in the model on each other

	SB			ACH			WB		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
SR	-.39	---	-.39	---	.16	.16	---	.32	.32
TSR	-.40	---	-.40	---	.16	.16	---	.32	.32
PR	-.15	---	-.15	---	.06	.06	---	.12	.12
FIS	-.30	---	-.30	---	.12	.12	---	.24	.24
SB	---	---	---	-.40	---	-.40	-.81	----	-.81

The examination of the standardized total, direct, and indirect effects presented in Table 4 regarding the final structural model of the study indicated that variables, such as self-regulation (d = -.39), student-teacher relationships (d = -.40), peer relationships (d = -.15) and family involvement to school (d = -.30) had direct and negative effects on school burnout. According to Cohen (1988), the effect size assessment includes the following classification: low when the value is less than .20; moderate when the effect value is between .30 and .50 and high when the effect value is .60 or greater. Based on this classification, the effects of the variables of self-regulation, student-teacher relationships and family involvement to school on school burnout were moderate, and the peer relationships variable had a low effect. When the effects of the variables on academic achievement were examined, it was found that the school burnout variable (d = -.40) had a moderate and direct effect, while variables, such as self-regulation (d = .16), student-teacher relationships (d = .16), peer relationships (d = .06) and family involvement to school (d = .12) had a low and indirect effect. The examination of the effect values of the variables on well-being, another dependent variable of the study, indicated that the school burnout variable (d = -.81) had a high and direct effect, whereas self-regulation (d = .32) and student-teacher relationships (d = .32) variables had an indirect and moderate effect, and peer relationships (d = .12) and family involvement to school (d = .24) had a low and indirect effect.

Conclusion and Discussion

In conclusion, the holistic evaluation of the analysis results of the hypothetical structural equation model established in this study indicated that all the hypotheses tested were accepted. The results obtained within the scope of this research regarding the tested hypotheses can be interpreted as follows based on the literature: the first hypothesis of the study was established as *'self-regulation is a negative and significant predictor of school burnout'* and as a result of the analysis, this hypothesis was accepted. When the literature was examined, there were studies that revealed the relationships between students' school burnout levels and self-regulation skills, though few in number. Kapıkıran et al. (2016) found that self-regulation in high school students predicted school burnout negatively and significantly. Similar results were found by Duru et al. (2014). Based on the results of this research, it is possible to say that as the self-regulation skills of the students increase, they may experience less school burnout. Moreover, Edelwich and Brodsky (1980) stated that individuals might experience burnout when their high-level expectations were not met, that is, when their expectations resulted in disappointment. At this point, self-regulation skill comes into play as a protective factor in the emergence of burnout or in preventing the negative effects of burnout on the individual. Self-regulation refers to the individual's spontaneous action, sorting out redundant information and taking the responsibility to make a choice among numerous options and to implement this decision (Baumeister and Vohs, 2007; 2012). Accordingly, it is possible to say that students with high self-regulation skills can primarily form healthier goals and expectations. Healthy goals and expectations based on the individual's own abilities and limitations will prevent disappointments that may occur afterwards. Moreover, these students will be able to make healthier choices among the alternatives

thanks to their ability to organize their own emotions, thoughts, and behaviors and to turn these choices into correct and timely behavior. As a result of all these, they will be protected from the negative effects of school burnout.

Another hypothesis tested within the scope of the study was established as *'student-teacher relationships are a negative and significant predictor of school burnout'* and as a result of the analysis, this hypothesis was accepted, as well. In this study, the student-teacher relationship refers to how and to what extent the basic psychological needs (such as i. autonomy, ii. competence and iii. relatedness) which are central to the theory of self-determination are met in the relationship established between students and teachers. From this point of view, based on the data obtained from this research, it can be said that as the level of meeting the basic psychological needs (such as i. autonomy, ii. competence and iii. relatedness) in the relationship established between students and teachers increases, the level of school burnout that students will experience will decrease, as well. According to Santrock (2012), the development of adolescents is greatly influenced by teachers, and when teachers make efforts to make their school and classroom environments more personal, less formal, and more motivating, especially middle and high school students can be positively affected by this situation. Besides, there are various studies in the literature that can be a source of information about the interaction between students' school burnout and their relationships with their teachers. For example, Shih (2012; 2015) found that there was a negative relationship between the autonomy support perceived by students from their teachers and the burnout they experienced, and significant positive relationships between the psychological control perceived from the teacher and school burnout. Based on the results of this study, it can be said that the increase in the perceived autonomy support in their relationships with their teachers decreases the burnout experienced by the students, while the increase in perceived psychological control increases burnout. Salmela-Aro et al. (2008) concluded that the positive motivation perceived from the teacher had a significant negative relationship with school burnout. Also, Raufelder et al. (2014) and Reeve (2012) found that perceived self-determination in the student-teacher relationship (the satisfaction of autonomy, competence, and relatedness needs) had a positive relationship with students' school attachment, which was especially noteworthy. This finding suggests that students who get more satisfaction with autonomy, competence, and relatedness needs in their relationships with their teachers than their peers will be more connected to the school, and that students who are more connected to school will indirectly experience less school burnout. The evaluation of all these research results together indicate that when the level of meeting the basic psychological needs (such as i. autonomy, ii. competence and iii. relatedness) in the relationship established between students and teachers increases and when the positive quality of these relationships becomes stronger, the school burnout that students experience will tend to decrease (Cho ve Jeon,2019).

The third hypothesis tested within the scope of the study was *'peer relationships are a negative and significant predictor of school burnout'* and this hypothesis was accepted as a result of the analyses done in the study. Accordingly, it can be said that as the positive supportive relationships that students establish with their peers increase, their school burnout will decrease. There are various studies in the literature on the interaction between the relationships that students have with their peers and the burnout they experience related to school. At this point, studies that especially reveal the relationship between social support that students receive from their peers and school burnout stand out. For example, Zhang and Zhu (2007) concluded that there was a negative and significant relationship between perceived social support from peers and burnout experienced by students. This finding, which shows that school burnout decreases as the perceived social support from friends and peers increases, is also supported by other studies in the literature (Kutsal, 2009; Çam and Öğülmüş, 2021). There are also various studies that show the social support students perceive from their friends and peers reduces school burnout and that those who receive social support experience more burnout than those who do not (Beltran, Moreno, Estrada, Lopez, and Rodriguez, 2009; Gündüz, 2005; Jacobs and Dodd, 2003). Cırcır (2018) found that there were significant negative relationships between student interactions sub-dimension of school climate and school burnout. Also, Kim, Yoon, and Jung (2016) similarly concluded that there were significant negative relationships between positive relationships that students had with their classmates and the academic burnout they experienced in general terms. When the results of all these studies aiming to reveal the relationship between the support received from peers and the quality of the relationships established with peers and school burnout were evaluated together, students' ability to establish positive peer relationships as well as the increase in social support perceived from their peers and friends can be considered as a protective factor in reducing the negative effects of school burnout.

Another hypothesis tested within the scope of the study was *'family involvement to school is a negative and significant predictor of school burnout'* and the analyses indicated that this hypothesis was accepted, too. Family involvement plays an important role in healthy adolescent development, as frequently stated in the literature. At this point, family (mother and father) involvement is considered as an important predictor of adolescents' mental health (Kuzucu and Özdemir, 2013) and a factor that plays an important role in adolescents' well-being (Flouri and Buchanan, 2003). Accordingly, it can be said that family involvement to school can play a protective role for various academic, social, and emotional problems that students may encounter during their education process and thus bring about a positive effect on their development process. In the literature, it is noteworthy that studies on family involvement at high school level are quite limited (Lindberg and Demircan, 2013). For this reason, no study that directly examined the effect of family involvement on school burnout at high school level was found, but there were various studies that gave an idea about the relationship between school burnout and family involvement, though indirectly. For example, Gonzalez-DeHass, Willems, and Holbein (2005) stated that as family involvement to school increased, students exhibited more attention, effort, and concentration towards school and lessons. Moreover, it is stated that as family involvement increases, students are more intrinsically interested in learning processes, feel more perceived efficacy, are more resistant to academic difficulties, and experience more satisfaction with school assignments.

In other studies drawing attention to the interaction between school burnout experienced by students and family involvement to school, studies examining the role of families as an important source of social support are remarkable. In various studies in the literature, perceived social support from the family is evaluated as an important factor in reducing school burnout (Alarcon, Edwards, and Menke, 2011; Çam and Öğülmüş, 2021; Kutsal and Bilge, 2012). When the results of these studies, which examine the role of parents as an important source of social support, are evaluated together, it can be said that the social support provided by parents to students will reduce school burnout. In addition to family involvement and perceived social support from parents, the relationships between parental monitoring and school burnout have also been examined, and it has been concluded that school burnout decreases as parental monitoring increases (Durmuş, Aypay, and Aybek, 2017). When all these research results are evaluated together, it can be said that family (mother and father) involvement to the education and school life of the student will reduce the school burnout of students both directly and indirectly through school engagement, adaptation, and involvement.

The fifth hypothesis of the study aimed to examine the relationship between academic achievement and school burnout, which is one of the main educational outcomes of the education system. The analyses revealed that the hypothesis that *'school burnout is a negative and significant predictor of academic achievement'* was accepted. In the literature, school burnout is considered as an important factor affecting the academic success of students from various educational levels (Walburg, 2014). Seibert, Bauer, May, and Fincham (2017) concluded that there were significant negative relationships between students' burnout levels and their academic achievement. However, it is stated in the literature that as the academic achievement perceived by students increases, the school burnout they experience decreases (Kutsal and Bilge, 2012). Research results have revealed that the burnout experienced by students is related to the decrease in academic performance (May, Bauer, and Fincham, 2015) and that students with less burnout show more academic success (Lee et al., 2010). When all the results of these studies examining the relationship between school burnout and academic achievement are evaluated together, it can be said that school burnout has a significant negative effect on academic achievement (Salmela-Aro et al., 2008; Yang, 2004, Külekçi-Akyavuz, 2020). In other words, it can be stated that as school burnout experienced by students increases, their academic success may decrease. In this respect, the school burnout experienced by students can be considered as an important risk factor for academic success.

The sixth and last hypothesis of the study was established as *'school burnout is a negative and significant predictor of well-being'* and this hypothesis was also accepted as a result of the analyses. In the literature, school burnout is considered as an important factor that negatively affects the well-being of students studying at various educational levels (Cadime et al., 2016; Kara, 2014; Murdock, 2013). Raiziene et al. (2014) concluded that there were significant negative relationships between students' school burnout and their subjective well-being. This finding showing a negative relationship between students' school burnout and their subjective well-being has also been supported by various studies in the literature (Aypay, 2017; Aypay and Eryılmaz, 2011). Similar to these findings, Tuominen-Soini and Salmela-Aro (2014) concluded that there were negative significant relationships between students' school burnout and self-esteem, positive significant relationships between students' school burnout and depressive symptoms which they considered as indicators of general well-being, and there were significant positive relationships with depressive symptoms. Based on all these findings, it can be said that the increase in the level of school burnout experienced by students will negatively affect their well-being.

The evaluation of the findings obtained in line with the hypotheses of this study, which aimed to examine the effects of school burnout on academic achievement and well-being holistically, suggested that school burnout was an important risk factor that negatively affected both academic achievement and well-being. Besides, the results of the present study revealed that school burnout was affected by the developmental context that students were in.

Limitations and Recommendations

In addition to all these findings, the research had some limitations. To eliminate these limitations and increase the bulk of knowledge about the problem of the research, the following issues are recommended for future researchers: (i) The generalizability of the model established within the scope of this research can be increased by retesting this research with data collected from students at different educational levels (e.g. secondary school) and from different regions. (ii) The research can be repeated with the support of qualitative research design to obtain more in-depth data about the relationships between variables in the model tested in the research. (iii) In this study, the propositions of the ecological theory were used to provide theoretical support to the research, but the theory was not tested directly in the study. From this point of view, the scope of the research can be expanded by using all steps of the ecological theory directly and different data sources related to these steps (students themselves, family, peers, teachers, etc.). (iv) In addition, different studies can be planned to reveal the mediator and moderator variables that have the potential to affect the relationship between school burnout and well-being and academic achievement, as well as the relationships between self-regulation, peer relationships, student-teacher relationships and family involvement to school.

Based on the findings of the present research, we recommend the following issues to practitioners, especially those who work in the field of psychological counseling and guidance: *(i)* Various applications can be planned and implemented to develop self-regulation skills in accordance with the developmental, protective, and preventive function of psychological counseling and guidance. Accordingly, psycho-education, peer counseling, individual guidance, and group guidance activities can be utilized. *(ii)* Social skills and/or assertiveness training programs can be used to improve the positive quality of students' peer interactions. *(iii)* In addition to these studies to be carried out with peers, studies can be conducted with teachers, in accordance with the consultation function of guidance (consultancy), to ensure the satisfaction of the need for autonomy, competence and relatedness in the relationship particularly between students and teachers. These studies are thought to be especially important for adolescents to establish healthy relationships with both their peers and teachers. *(iv)* When the literature is examined, it can be seen that especially at the secondary education level, family involvement to school is not at the desired level, and there is not enough research on family involvement to school. Accordingly, various studies that support the family involvement to school can be planned and implemented to reduce the school burnout experienced by students and to support academic success and well-being.

Notes

This article is based on the first author's doctoral thesis titled *"Investigation of The Effect of School Burnout on Academic Achievement and Well-Being with A Holistic Approach in High School Students"* prepared under the supervision of the second author.

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