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Full Length Research Paper

The relationship between the protective factors and science and mathematics achievements of the socioeconomically disadvantaged students

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ABSTRACT

This study aims to investigate the relationship between some protective factors and the academic achievements in science and mathematics classes of socioeconomically disadvantaged eighth-grade students. The quantitative research method and relational screening model were employed in the research. The sample of the study consisted of 250 students between the ages of 12 to 13, who were at the eighth-grade level, from a small province in Eastern Anatolia. Research data were collected from the seventh-grade science and mathematics achievement scores of the students to whom the school attachment, cognitive flexibility, and social support scales were applied. As a result of the analysis consisting of the Pearson Correlation Coefficient; there was a positive significant relationship between school attachment, social support, and cognitive flexibility protective factors and students' science and mathematics achievement scores. It has been observed that the results of this study are compatible with the results of the studies conducted on similar subjects in the literature.

Keywords: Cognitive flexibility, school attachment, science and mathematics education, social support, socioeconomic status.

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INTRODUCTION

The world is changing and developing continually. As long as the countries keep up with this change and development, they can exist more powerfully. For this, they should create solutions to the problems they encounter and overcome these problems. One of the basic keys to the solutions to these problems is education. Educating well-equipped and intellectual individuals will make it easier for countries to find solutions to the problems they may encounter. According to Yenilmez and Duman (2008), the basic purpose of education is to train individuals with the ability to think, be productive, fast and solve problems in different ways, developed a personality totally with social relations and values. In an education process aiming to educate individuals who can produce, solve problems and develop the individual as a whole, the education and training activities, specifically at the primary and secondary education levels, which are the compulsory education periods, are of great significance.

According to Eş and Sarıkaya (2010), countries stress that it is necessary to give better education to their citizens, and science education will have a key role in this process to be more powerful in the future. As time passed, human needs have changed and increased; this case, even more, increased the significance of science education to meet the changed and increased needs in human life in preparing the individual for the society and future. As in the whole world, as a result of the recognition of the necessity and importance of science education in Turkey, the number of research on science

education conducted in our country has significantly increased in recent years (Güneş and Karaşah, 2016).

Mathematics is needed in finding solutions to the encountered problems in the change and development of science and technology. As science education, even mathematics education has a key role in meeting the changing needs of people and in the solution of problems. People often come across mathematical situations in their daily life and use mathematical terms in understanding and solving these situations. Developing and using mathematics skills enables the individual to overcome several problems that s/he encounters in daily life (Yenilmez and Duman, 2008).

Turkey participates in international applications in the science and mathematics field that enable countries to form their knowledge and research strategies. The Program for International Student Assessment: PISA and The Trends in Mathematics and Science Study: TIMSS are among the international large-scale test applications that Turkey participate. TIMSS, which is arranged in four-year periods for the 4th and 8th class students, is held to determine and evaluate the knowledge and skills of these students in the field of science and mathematics. PISA is a screening activity, held every three years by the OECD, related to determining the knowledge and skills of students at the age of 15 in the fields of science, mathematics and problem-solving and reading skills. It is remarked that the achievement of Turkish students increased compared with the previous years; however, the rank of Turkey among the other countries that participated in the PISA and TIMMS applications has not reached the desired level, yet (Aru, 2020).

That science and mathematics education is significant for the future of the countries and that the science and mathematics student achievement is not at the desired level in Turkey have led to several pieces of research to determine the factors relevant to the student achievements in science and mathematics courses. In the studies, conducted using the data of the TIMSS 1999, it was determined that the most important factors influencing students' science and mathematics achievements were the education levels of parents, socioeconomic level, achievement-failure perceptions of students and student-centred activities (Berberoğlu et al., 2003; Yayan and Berberoğlu, 2004; Ceylan and Berberoğlu, 2007). Thomson et al. (2003) suggest that the features affecting students' mathematics achievements are attitudes of the students toward mathematics, socioeconomic status of the family, gender, teacher factor and school factor. Anıl (2009) refers that the education level of the father is the most significant factor related to the science course achievements of the students in the 15-age group within the scope of the PISA 2006. Özer and Anıl (2011) refer that the factors relevant to the science course achievements of students are time spent learning, education materials, parents' education status, and the number of books in students' houses; on the other hand, the factor relevant to the mathematics achievements of the students is the time spent for learning, father's education status, mother's education status and the number of books in students' houses.

In the research, in which variables relevant to teachers and schools affecting the achievements of socioeconomically disadvantaged students in the field of science and mathematics literacy in Turkey were investigated according to PISA 2012 data, it was found that the learning results for the science course achievements of students with low socioeconomic level, the feeling of school attachment, openness to problem-solving, study time out of school and the desire for learning were the most crucial predictors for student achievement. The status of attitude towards school, learning activities, determination and openness to problem-solving were regarded as the determinants of mathematics achievement (Aydın, 2017). It is preferred that increasing the motivation of students for science is significantly associated with science achievement and thus increases participation in classroom activities (Yenice et al., 2012).

It is stated in other research of the literature that academic achievement even consisting of science and mathematics achievement is related to affective factors such as intelligence and learning speed, study habits, personality characteristics, motivation and self-efficacy; and with environmental factors such as socioeconomic status of the family, parental attitude, attitude and competence of teachers and school principals (Howie and Pieterson, 2001; Wang, 2004; Arıcı, 2007; Şevik, 2014; Sarıer, 2016).

As the findings of the conducted studies are analyzed, it is understood that socioeconomic status is a factor affecting the science and mathematics achievements of students. Socioeconomically disadvantaged individuals have various risk factors. The situations called the risk factor are the negative situations that individuals have. Difficulties and problems in people's lives are the risk factors that prevent life to continue in a positive way (Radke-Yarrow and Sherman, 2002). The most critical one among the risk factors can be claimed as the status of being economically disadvantaged. Because, being economically disadvantaged causes some social negativities such as inadequate care and nutrition for prenatal and postnatal children and low education levels (Brackenreed, 2010). This negatively affects the characteristics of the person such as self-confidence, social development, autonomy and self-awareness, and problem-solving skills (Yavuz and Kutlu, 2016).

To decrease the risk status of socioeconomically disadvantaged individuals, the individual must develop protective factors in his/her life. Protective factors are resources enabling the individual, who has a risk factor, to mitigate, reduce or eliminate the effect of the risk or difficulty, and improve the individual's adaptation and competencies (Masten, 1994). Protective factors are

divided into two, that is, individual (internal) and environmental (external) protective factors.

Individual protective factors are the internal factors that contribute to science and mathematics achievement. Problem-solving skills, interest, self-confidence, ambitiousness, flexibility, communication skill, self-respect, determination, having a sense of responsibility, social competence, autonomy, etc. can be given as examples of individual factors (Werner, 1990; Masten, 1994; Kumpfer, 1995; Benard, 2004). Other protective factors are environmental (external) factors. Environmental factors can be referred to as encouraging conversations of parents and relatives to the individual, giving opportunities to develop self-confidence and self-respect, showing care and attention to the individual, reasonable guidance to the individual, the individual getting support from environmental factors such as peer, teacher, etc. can be given as the examples to the environmental protective factors (Yavuz and Kutlu, 2016).

As the insufficient opportunities of economically disadvantaged students are taken into consideration, the school has a significant role in increasing the education levels of these students. For this reason, the school attachment levels of socioeconomically disadvantaged students with a high level of science and mathematics achievement are expected to be high.

In addition, the school attachment determines the thoughts of students related to the school environment and teachers, it shows the willingness to participate in the in-school and out-school activities (OECD, 2003). It can also be explained as having the belief of being valued and respected as a member of the school (Roeser et al., 1996; Samdal et al., 1999), participating in the in-school and out-school activities and identifying him/herself with the school. Some researchers explain this concept as motivating the student to school, concerning relationships with teachers and classmates, with an approach that reflects a belief in value and competence towards school activities (Faircloth and Hamm, 2005; Juvonen, 2006; Savi, 2011). The atmosphere at school and teacher-student relationships are among the significant factors in increasing the academic achievement level of school.

Roeser et al. (1996) define school attachment as "an individual thinking that s/he is valuable, supported and respected in the school of which she/he is a member, feeling of belonging to the school". In the conducted studies, it was found that the feeling of belonging to the school increases academic achievement including science and mathematics achievement (McMahon et al., 2008; Anderson, 2010; Özdemir et al., 2010; Duru and Balkıs, 2015; Sarı et al., 2017). With the expression of Roeser et al. (1996) in the definition of school attachment as “individual’s feeling of belonging to school”, we can state that school attachment increases science and mathematics achievement considering the feeling of belonging to school increases the academic achievement including to science and mathematics achievement that state in the studies of the literature. In the study conducted by Aydın (2017), it was determined that student's feeling of school attachment was a significant predictor of science achievement and attitude towards the school for mathematics achievement. Thomson et al. (2003) refer that one of the factors that affect the mathematics achievement of the student is the school factor. Even in these studies, the status of school attachment is relevant to science and mathematics achievement.

Attachment of a socioeconomically disadvantaged student to school is a significant factor in motivating the student to achieve and protecting him/her from the risk factor. Because the school has a role of a bridge for students in risky situations. Negative teacher-student relationships which are among the indicators of school attachment cause low participation of students in the in-school and out-school activities. In addition, low performance and interest in in-class and out-class activities increase students' demonstrating problematic behaviours and increase the possibility to leave school. School attachment is a protective factor that prevents negative life results for students and increases life results of them (Yavuz and Kutlu, 2016).

Another protective factor that is thought to affect the science and mathematics achievement of socioeconomically disadvantaged students is the factor of social support. Although there is no definition that a full consensus is provided on related to social support (Hutchison, 1999), the most widely accepted definition in the literature was put forth by Cobb (1976). Cobb (1976) defines social support as "information that makes a person believe that she/he is loved, valued, cared for and a member of a social network with mutual obligations" (Gökler, 2007). Social support can also be defined as providing financial and moral assistance ensured by people around the person under stress or in a difficult situation, making the individual believe that s/he is loved and valued, reducing negative consequences in his/her life and facilitating his/her adaptation to life (Meral and Cavkaytar, 2012).

Resources enabling social support can be family, friends, peers, teachers, and other various resources. The first resource that is reminded first as social support is family. Because family is the first social environment of the individual and she/he realizes his/her first learning in terms of socialization in this environment. The absence of social support may produce a risk in terms of physical and emotional problems among children and adolescents (Kızıldağ, 2009).

Considering the definitions of the social support concept in the literature, we can state that this concept will contribute to the feature of ensuring life support that is necessary for the individual or the individual will need. According to Perrine (1999), social support consists of two main elements. One of these is the objective presence of other people during the looking for help when

the individual is under stress. The second is the perception of social support. On the one hand, the first of these refers to the sources of support that exist in the individual's social environment, on the other hand, the second refers to the person's perception of his/her sources of support. In other words, it is the perception of support that actually exists but is perceived differently by the individual (Kızıldağ, 2009).

The social support that the students with risk factor perceive motivate them to succeed (Nettles et al., 2000). The social support perceived by teachers increases the learning motivations of students (Chhuon and Wallace, 2014). It is referred that increasing the motivation of students is significantly related to science achievements (Yenice et al., 2012). It is stated that students with high academic achievements get more support from their parents compared with their peers with low academic achievements (Perez et al., 2009; Yüce, 2019). It was observed that children who grow up in families with healthier communication have better academic achievement (Yıldırım, 2019). In the research that take place in the literature, as academic achievement is thought to consist of science and mathematics achievements, it can be concluded that the students who can get support from their parents and have healthier communication have better science and mathematics achievements.

Lee and Smith (1999) concluded that the social support that students get was related to learning in a positive direction. The social support factor that increases students' learning situations will also contribute to their science and mathematics achievement. It is referred that teacher-student relations (Erden et al., 2014) and peer support (Turner, 1999; Salı and Köksal-Akyol, 2010; Yıldırım, 2019) are interrelated in a positive direction with academic achievement including science and mathematics achievements. Considering the results of these studies, it can be claimed that the social support such as family, teacher and peer support that students get from the environment is a factor that positively predicts the science and mathematics achievements of students.

Another protective factor that we believe to be interrelated with the science and mathematics achievements of disadvantaged students is the factor of cognitive flexibility. According to Payne et al. (1993), flexibility is the capacity of individuals to show coherence. However, this coherence may not occur in all situations. Even if the result of the behavior of the individual, who behave flexibly to cope with the change that happens in the environment, is negative, we should mention the cognitive flexibility even in this case. According to Martin et al. (1998), those who demonstrate flexibility in their daily lives are not only flexible in their daily lives, in a situation and only at a certain time. This case also shows that cognitive flexibility can be a general situation (Çelikkaleli, 2014a).

It is stated that individuals, who express themselves as cognitively flexible, even regard themselves as quick-witted, careful, confident and understanding (Martin and Anderson, 1996). Martin and Rubin (1995) referred that individuals with a high level of cognitive flexibility have higher self-observation skills and a higher belief in self-efficacy compared with those with a low level of cognitive flexibility. Cognitive flexibility was determined- with the conducted studies – to be interrelated with language (Jacques and Zelazo, 2005), problem-solving skills and social self-efficacy belief (Bilgin, 2009), being tolerant, not being quarrelsome (Martin and Anderson, 1998) and depression (Merrill et al., 2005). As the conducted research and studies are thought of as a whole, it is seen that cognitive flexibility has a positive relationship with positive situations and psychological features, and a negative relationship with those that are negative (Çelikkaleli, 2014b).

The study by Alper and Deryakulu (2008), carried with high school first-class students, concluded that the variable of cognitive flexibility had a significant influence on student achievement and the permanence of learning. As student achievement and learning permanence will even contribute to science and mathematics achievement, it can be referred that cognitive flexibility is interrelated with science and mathematics achievement as a result of this study. Kercood et al. (2017) found a positive significant relationship even between objective cognitive flexibility and mathematical literacy skills in their study.

Students with high cognitive flexibility are referred to have high problem-solving skills (Stevens, 2009). Taş and Deniz (2018) determined a positive relationship between problem-solving skills and cognitive flexibility in their study. Furthermore, in a similar study, the cognitive flexibility of the students who try various ways of solutions and believe to be successful as a result of these trials was determined to be high (Bilgin, 2009). In the study by Çelikaleli (2014b), it was determined a positive significant relationship was found between cognitive flexibility and the belief in academic competence.

As the literature is reviewed, it is observed that particularly different variables have been investigated rather than the relationship between cognitive flexibility and science and mathematics achievement. However, these variables are the factors that have a relationship with science and mathematics and contribute to science and mathematics achievements. In the sample researches, it is suggested that there are significant relationships between cognitive flexibility and problem-solving or situations such as producing different solutions to the problem, belief in being successful and academic competence. Both academic competence and problem-solving or producing various ways of solution to the problem are the variables that contribute to science and mathematics achievement. Because, a student can contribute to his/her academic achievement by producing

ways of solving more than once the problem that s/he encounters, providing academic competence. So, considering the results of the research investigating the relationships between the variables mentioned above and cognitive flexibility, it can be expressed that there is a relationship between cognitive flexibility and science and mathematics achievement.

Being socioeconomically disadvantaged may cause failure in the academic life of the individual and leaving school (Yavuz and Kutlu, 2016). It is stated that the effect of the risk or difficulty can be softened, reduced or eliminated in the students with this risk factor with protective factors (Masten, 1994). Considering the thought that it will be beneficial for the students with the same risk situations and the other stakeholders of education, by taking the factors of school attachment, social support, cognitive flexibility and psychological resilience from the protective factors that can play a role in academic achievement in science and mathematics, the relationship of these factors with the academic achievement of socioeconomically disadvantaged students in science and mathematics course was investigated. It is thought that our study will positively contribute to the science and mathematics achievements of students with the socioeconomically disadvantaged situation, and guide the authorities on what can be done to reduce their risk factors.

Problem statement

In the literature reviews, it is stated that one of the most important factors that influence students' science and mathematics achievements is the socio-economical level. In addition, it is referred to in the research that decreasing or diminishing the risks or difficulties, which socio-economically disadvantaged students have, can be provided with protective factors. Thought that it will contribute to the science and mathematics achievements of disadvantaged students has emerged. Accordingly, the current study presented the following main question: Is there a relationship between the science and mathematics academic achievements of the eighth graders, who are socio-economically disadvantaged, and the protective factors? And it raises the following sub-questions:

1. Is there a relationship between the social support variable and the science and mathematics course achievement status of the eighth graders who are socio-economically disadvantaged?
2. Is there a relationship between psychological resilience and the science and mathematics achievements of eighth graders who are socio-economically disadvantaged?
3. Is there a relationship between the cognitive flexibility variable and the science and mathematics achievement status of the eighth graders who are socio-economically disadvantaged?
4. Is there a relationship between the school attachment perceptions and the science and mathematics achievement status of the eighth graders who are socioeconomically disadvantaged?

Purpose of the study

In this research, it was aimed to investigate the relationship between cognitive flexibility and psychological resilience from the intrinsic protective factors, school attachment and social support status from the environmental protective factors and science and mathematics academic achievements of the eighth graders who were socio-economically disadvantaged.

METHODOLOGY

Research model

This research was conducted with the quantitative research method and of the correlational research type, one of the relational screening models.

Participants

The research group consists of 250 socioeconomically disadvantaged secondary school eighth-grade students between the ages of 12-13. The study was carried out with a total of 250 eighth-grade students, 123 of whom were male and 127 were female, from 20 secondary schools consisting of neighborhoods, towns and villages located in the central district of the province in which the study was conducted. The disadvantageous status of the students is presented in Table 1. As all of the 250 students, consisting of the sample of the study, were with an income below the financial neediness limit, they are not indicated in the category of disadvantageous status in the table.

Procedures

The data gathered from the Social Assistance and Solidarity Foundation, affiliated with the governor's office of the province, from which the research was carried out, were used in determining the socioeconomically disadvantaged eight grade students. The socioeconomically disadvantaged families were determined with the permission of the foundation board of trustees of the household investigation reports and central system data performed in the field by the Social Investigation Officers of the Social Assistance and Solidarity Foundation. The identified households

Table 1. Demographic statistics of the study group.

	n	%
Gender		
Female	127	50.8
Male	123	49.2
Disadvantaged conditions		
Students with dead parents	6	2.4
Students with divorced parents	42	16.8
Students with fathers in prison	8	3.2
Students with a disabled person in the family	17	6.8

consisted of families who were below the neediness limit in terms of economy in accordance with Article 2 of Law No. 3294. These families are at risk not only economically, but also socially, including various problems such as the presence of a disabled person in the household, the death of one or both parents, and the divorce of parents. This is within the light of the data gathered from the Social Assistance and Solidarity Foundation considering the ethical rules.

Data collection tools

The data were collected in the fall term of the 2019-2020 educational year. To determine the ethical suitability, necessary permissions were taken from the Humanitarian Research Ethics Committee of the university to which the research was affiliated, and the Provincial Directorate of National Education and the Social Assistance and Solidarity Foundation to collect the data. Practices were carried out in classrooms of the students by a teacher and a researcher to ensure that socioeconomically disadvantaged students would not feel discriminated against. The students were asked to fill out the forms without writing their names during the survey practice. Codings were performed according to the order in the class list by giving codes to the questionnaire forms and the forms were distributed according to the order of the class list. Thus, which student took which coded form is known. The seventh-grade final science and mathematics course achievement scores of the students in the study group were obtained from the registered forms of the school administration. The tools used to collect the data were the information forms, the social support evaluation scale for children, the psychological resilience scale for children and adolescents, the school attachment scale for children and teens and the psychological flexibility scale.

Information forms

The information form, the parent consent form and the participation acceptance form were used in our research. The parent consent form and the participation acceptance form were obtained from the website of the Ministry of National Education during the process of taking the necessary permission. Before applying the forms to the students the parent consent forms were sent to the parents via the class guidance teachers, and the scales were started to be implemented, considering the forms consented by the parents. Additionally, the participation acceptance form was distributed to the students with the scales. The parent consent form consists of the permission certificate which was signed by the guardian with the name and aim of the research, confidentiality and voluntary information, that it was conducted by obtaining the necessary permissions from the Humanitarian Research Ethics Committee and the Ministry of National Education of the affiliated university. Besides, the parent consent form consists of a signed permission document, indicating that the participant agrees to participate in the research, including the name and aim of the research, confidentiality and voluntary information, which is done by obtaining the necessary permissions from the Humanitarian Research Ethics Committee of the affiliated university and the Ministry of National Education.

Social support evaluation scale for children

While the scale developed by Dubow and Ullman (1989) formerly consisted of 31 items, with the study by Dubow et al., (1991), 10 new items, related to the support by peers and teachers, were added to the scale, thus its final form consists of 41 items. After the items in the scale were translated into Turkish by the researcher for the adaption work, they were compared with the English form by three clinical psychologists and necessary arrangements were performed. Then, the final form of the scale was prepared considering all the suggestions (Gökler, 2007). The items of the scale, which were in the form of 5 points Likert-type, were grouped under three sub-factors as peer support, family support and teacher support. To determine the construct validity of the scale, Gökler (2007) stated that the total variance of the items

predicted 40.22% of the scale and obtained factor structure was consistent with the results of Dubow and Ullman (1989) by analyzing with varimax axis rotation method. Besides, as a result of the internal consistency analysis by Gökler (2007) the Cronbach Alpha internal consistency coefficient was found as 0.93. The internal consistency coefficients gathered for the sub-dimensions of the scale were calculated as 0.89, 0.86 and 0.88 respectively for peer support, family support and teacher support. Considering the various statistical analysis results related to the factor structure, criterion validity, internal consistency, test-retest, split-half and item-total reliability of the Turkish form of Gökler (2007), it was concluded that the Social Support Evaluation Scale for Children is a valid and reliable tool. The Cronbach Alpha internal consistency coefficient analysis result was found as 0.90 for this scale in the present study.

The school attachment scale for children and adolescents: The Turkish adaptation of the scale which was developed by Hill and Werner (2006), was carried out by Savi (2011). The scale, which consists of 12 items, includes three factors, that is, “teacher attachment”, “peer attachment”, and “school attachment”. The scale developed to determine the school attachment levels of children and adolescents is a 5-point Likert-type. The highest scores on the scale demonstrate the high attachment of the student to school, and low scores the status of low attachment to school.

In the factor analysis to determine the validity of the scale, the Varimax method was applied. As a result of the analysis by Savi (2011), it was seen that the items of the scale were grouped under three factors predicting 58.69 % of the total variance. 4th and 14th items, which both had low common variance and were detected to decrease the internal consistency of the scale, were omitted from the scale. It was determined that the obtained factor structure was consistent with the results of Hill and Werner (2006) and that the items were under the factors that they aimed to measure as in the original scale (Savi, 2011). The Cronbach Alpha internal consistency coefficient for all of the scales was found as 0.84. The Cronbach Alpha Reliability Coefficients of the sub-factors of "school attachment", "peer attachment" and "teacher attachment" of the School Attachment Scale for Children and Adolescents were respectively found as 0.82, 0.71 and 0.74 (Savi, 2011). The reached results demonstrated that the reliability and validity values were at an acceptable level (Andy, 2017; George and Mallery, 2019). The Cronbach Alpha internal consistency coefficient was found as 0.87 for this scale applied in this study.

Cognitive flexibility scale

The Cognitive Flexibility, developed by Scale Martin and Rubin (1995), was adapted to Turkish by Çelikkaleli (2014a). The scale is a 5-point Likert-type scale consisting of 12 items. To test the construct validity of the Cognitive Flexibility Scale, both the exploratory factor analysis and the confirmatory factor analysis were applied. In the exploratory factor analysis, it was observed that the correlation coefficients between the items of the scale differed between 0.20 and 0.43 ($p < 0.01$), and had a structure consisting of a single factor predicting the variance in the cognitive flexibility scores at the rate of 43%. With this finding, it was determined that the items exemplified similar behaviors and the internal consistency of the test was high (Büyüköztürk, 2007). In the confirmatory factor analysis, the fit indices of the model were analyzed and the Chi-square value was found to be significant. The Cronbach Alpha internal consistency coefficient was found as 0.74 for reliability, the test-retest correlation coefficient (three weeks apart) was 0.98 and the Split-half reliability of the scale was 0.77 (Çelikkaleli, 2014a). The results reached from the studies on the validity and reliability of the Cognitive Flexibility Scale demonstrated that the values were acceptable (Andy, 2017; George and Mallery, 2019). As a result of the analysis result for this scale in the present study, the Cronbach Alpha internal consistency coefficient was found as 0.71.

Data analysis

The data gathered through the applied scales during the research process were transferred to the computer environment first. The interpretation of the findings gathered from the relevant scales in the research was performed by using the statistics program. Before the analysis of the handled findings, the data were analyzed in terms of the normal distribution. The science and mathematics achievement scores applied in the study and whether the distributions of data from all scales meet the assumption of normal distribution were analyzed by examining the kurtosis skewness values and normal distribution graph. If the kurtosis and skewness values of a sample of data in social sciences research change between +1.5 and-1.5, the data stack belonging to this group is considered to be normally distributed (Tabachnick and Fidell, 2013). The scores of the family sub-dimension of the Social Support Evaluation Scale for Children and the school and peer sub-dimensions of the School Attachment Scale for Children and Adolescents do not meet the normal distribution assumption. For this reason, non-parametric analyses were applied in the analyses related to this sub-dimension.

In this scope, the Pearson Product Moment Correlation analysis was used for data analysis of parametric data, and Spearman Rank Difference Correlation analysis was applied for nonparametric data.

FINDINGS

The demographic statistics related to the variables in the

research are presented in Table 2. The mean of the Social Support Evaluation Scale for children was calculated as 167.4 (standard deviation 20.67). Among the sub-dimensions of the scale; the mean of the family sub-dimension was found as 53.5 (standard deviation of 6.72); the mean of the teacher sub-dimension was 39.28 (standard deviation of 7.21); the mean of the peer sub-dimension74.67 (standard deviation 11.80). The mean of the School Attachment Scale for Children and Adolescents was calculated as 51.35 (standard deviation 8.14). Among the sub-dimensions of the scale, the mean of the school sub-dimension was calculated as 17.37 (standard deviation of 3.64); the mean of the teacher sub-dimension was 17.29 (standard deviation of 3.15); the mean of the peer sub-dimension as 16.68 (standard deviation 3.07). The mean of the Cognitive Flexibility Scale was calculated as 45.57 (standard deviation 6.85). From the other variables, the mean of science scores was calculated as 67.64 (standard deviation 15.98), and the mean of mathematics scores as 59.90 (standard deviation 18.94).

Findings related to the relationship between social support and science and mathematics achievement

As it is indicated in Table 3, there is a positive relationship between peer which is among the sub-dimensions of social support and science course academic achievement scores ($r = .16$, $p < .05$). In addition, it is observed that there is a positive relationship between science course academic achievement and teacher support which is among the sub-dimensions of the social support ($r = .21$, $p < .01$), even positive relationship between total score of social support ($r = .22$, $p < .01$). It is understood that there is a positive relationship between mathematics course academic achievement and teacher which is among the sub-dimension of social support ($r = .17$, $p < .01$), even in a positive relationship between the total score of social support ($r = .15$, $p < .05$). Besides, there is a positive relationship between science course academic achievement and mathematics course academic achievement ($r = .71$, $p < .01$) is understood from Table 3.

Findings related to the relationship between cognitive flexibility and science and mathematics achievement

As it is indicated in Table 4, a positive relationship between science course academic achievement and cognitive flexibility total score ($r = .35$, $p < .01$) is realized. Besides, a positive relationship between mathematics course academic achievement and cognitive flexibility total score ($r = .24$, $p < .01$) is observed.

Table 2. Demographic statistics.

	Min.-max. score	Mean	Standard deviation	Kurtosis	Skewness	Cronbach alpha
Social support evaluation scale for children	41-205	167.4	20.67	-.26	-.60	.90
Family sub-dimension	12-60	53.5	6.72	2.96	1.65	.81
Teacher sub-dimension	10-50	39.28	7.21	1.104	-1.00	.82
Peer sub-dimension	19-95	74.67	11.80	.055	-.61	.87
School attachment scale for children and adolescents	12-60	51.35	8.14	1.40	-1.29	.87
School sub-dimension	4-20	17.37	3.64	2.57	-1.69	.89
Teacher sub-dimension	4-20	17.29	3.15	1.20	-1.27	.77
Peer sub-dimension	4-20	16.68	3.07	1.75	-1.23	.70
Cognitive flexibility scale	12-60	45.57	6.85	-.737	-.14	.71
Science score	0-100	67.64	15.98	-.66	.27	
Mathematics score	0-100	59.90	18.94	-.44	.34	

Table 3. Pearson correlation analysis results related to the prediction of a social support assessment scale for children.

	Peer	Family[a]	Teacher	Total	Science score	Mathematics score
Peer	1					
Family[a]	.460**	1				
Teacher	.458**	.502**	1			
Total	.860**	.696**	.777**	1		
Science score	.162*	.101	.211**	.218**	1	
Mathematics score	.105	.099	.166**	.154*	.711**	1

** p < .01 , * p < .05 , [a] = Spearman's rho.

Table 4. Pearson's correlation analysis results related to the prediction of cognitive flexibility scale.

	Total	Science score	Mathematics score
Total	1		
Science score	.350**	1	
Mathematics score	.238**	.711**	1

** p < .01.

Findings related to the relationship between school attachment and science and mathematics achievement

As it is indicated in Table 5, there is a positive relationship between teachers, which is one of the sub-dimensions of the school attachment and science course academic achievement (r = .17, p < .01). In addition, a positive relationship is realized between science course academic achievement and total score of school attachment (r = .14, p < .05). It is understood that there is a positive relationship between mathematics course academic achievement and teacher which is among the sub-dimensions of school attachment (r = .14, p < .05), even positive relationship with the total score of school attachment (r = .15, p < .05). In addition, that there is a positive relationship between science course academic achievement and mathematics course academic achievement (r = .71, p < .01) is understood from Table 5.

Table 5. Pearson's correlation analysis results related to the prediction of school attachment scale for children and adolescents.

	School[a]	Teacher	Peer[a]	Total	Science score	Mathematics score
School[a]	1					
Teacher	.586**	1				
Friend[a]	.450**	.422**	1			
Total	.808**	.831**	.767**	1		
Science score	.097	.165**	.100	.137*	1	
Mathematics score	.089	.141*	.068	.151*	.707**	1

** p < .01, * p < .05, [a] = Spearman's rho.

DISCUSSION AND CONCLUSION

The first question of the research was to determine whether there is a relationship between the social support perceptions of the socioeconomically disadvantaged secondary school eighth-grade students and their mathematics achievement status. According to the Pearson Correlation Analysis applied for this case, it was found that there was a positive relationship between the variable of social support and the science and mathematics achievement scores of the students. As the sub-dimensions of social support were evaluated in the analysis, it was found that there was a significant relationship between the two sub-dimensions consisting of peer and teacher support and science achievement. It was found that there was a more significant relationship between the social support sub-dimension from the teacher on science achievement compared with the peer

sub-dimension. A positive relationship between mathematics achievement and teacher support, among the sub-dimensions of social support, was determined.

In the research carried out with sixth and eighth-grade students, Lee and Smith (1999) reached the result that there was a positive relationship between the social support the students get and learning. It can be remarked that social support is in a positive relationship with learning and has a positive relationship with the learning situation in science and mathematics courses, therefore, even with the science and mathematics achievement status. Nettles et al. (2000) referred that the social support that students with the risk factor have to motivate them to succeed. It is referred that increasing the motivation of students is fairly correlated with the increased motivation of the students (Yenice et al., 2012). Considering the case that social support increases student motivation and high motivation is correlated with science achievement, it can be stated that social support is a positive relationship with science achievement.

Academic achievement is a factor that includes science and mathematics achievements. As the studies in the literature are reviewed (Yıldırım, 2019; Wang, 2004), there are the researchers determined to include the positive relationship between the social support factor and academic achievement (Nicpon et al., 2006; Yıldırım, 2006; Elias and Haynes, 2008; Perez et al., 2009; Rueger et al., 2010). For instance, in the study conducted with the disadvantaged 282 third graders, it was determined that the social support that the students perceive predicts their academic achievement (Elias and Haynes, 2008). Nicpon et al. (2006), found in their research, that they carried out with 401 university students, that there was a significant relationship between the social support levels of the students and their academic achievements. In another study, conducted with 636 secondary school students, it was found that as the social support that the students perceive increases, their academic compliances also increase (Rueger et al., 2010). Another study that demonstrates similarity with the results of the present study is the study conducted by Yıldırım (2006), with 962 students between the 8th and 11th class levels. At the end of the study, it was found that the academic achievement status of the students can be increased by empowering their social support systems. Since academic achievement is a factor that consists of the science and mathematics achievement status, from the results of this study, it can be remarked that there is a positive relationship between social support and science and mathematics achievements.

The results of the research, in which the social support–academic support achievement relationship both with the disadvantaged situations and with different age groups have been investigated, are in harmony with the results of the present study. According to the findings of this study, gathered from the sub-dimensions of social support, it can be referred that teacher and peer support are significant factors for science achievement and teacher support for mathematics achievement. Teachers' behaving with their students warmly and sincerely, arranging activities related to their students' motives and needs and helping their students with insufficient educational material may contribute to their science and mathematics achievement status. Teachers' organizing activities by considering the needs of students such as love, respect, belonging and success in their relations with students, and harmonizing student satisfaction with learning goals may even reflect their science and mathematics achievements. Arranging activities, that will increase the socialization of the students at school or in the classroom, may contribute to their science achievement.

The second question of the research was related to determining whether there was a relationship between the science and mathematics achievement status of the socioeconomically disadvantaged secondary school eighth-grade students and the variable of cognitive flexibility. According to the Pearson Correlation Analysis conducted on the gathered data, a positive significant relationship was detected between the variable of cognitive flexibility and the science and mathematics achievement scores of students. Accordingly, it can be referred that the student's cognitive flexibility levels are correlated with the science and mathematics achievement status of students.

As the studies in the literature are analyzed, there are researches demonstrating similarities between these findings and interpretations. In the research conducted by Masten et al. (2012) with 138 preschool students with the risk factor, it was found that students with high executive function skills, including cognitive flexibility, also have high academic achievement. As academic achievement consists of science and mathematics achievements, it can be stated that there is a positive relationship between cognitive flexibility and science and mathematics achievements. In the study consisting of high school first-grade students, Alper and Deryakulu (2008) concluded that the cognitive flexibility variable in web-based problem-based learning creates a significant influence on student achievement and learning permanence. Considering the finding of this research, it can be remarked that there is a positive relationship between cognitive flexibility and science and mathematics achievement. Because student achievement and permanence of learning are the factors that contribute to science and mathematics achievements.

In another study carried out with 638 secondary school eighth-grade students, a positive relationship was determined between problem skills and cognitive flexibility (Taş and Deniz, 2018). It is stated that students with high cognitive flexibility also have high problem-solving skills (Stevens, 2009). In addition, in similar research, the cognitive flexibility of the students, who try different ways of solution and believe that they will be successful as a result of these trials, are also high (Bilgin,

2009). Çelikkaleli (2014b) determined a positive significance in both academic competence and problem-solving or creating different solutions to the problem are variables that contribute to academic achievement in science and mathematics. Because, students can contribute to science and mathematics achievement by creating multiple solutions to the problem faced by, providing academic competence. So, exam achievement is the result of academic achievement. Therefore, the results of the research investigating the relationship between the variables mentioned above and cognitive flexibility demonstrate harmony with the results of the present study.

It was concluded that there was a positive relationship between the cognitive flexibility status of the socioeconomically disadvantaged students and their science and mathematics achievements. According to this result of the study, providing students with the skills to produce different solutions in problem situations, accessing information in different ways and transferring information to different events, and organizing activities that can improve their cognitive flexibility in school or other learning environments related to the socioeconomically disadvantaged students may be beneficial for increasing their science and academic achievements.

The third problem of the study was to determine the relationship between the school attachment variable and the science and mathematics achievements of disadvantaged secondary school eighth-grade students. According to the Pearson Correlation Analysis applied for this case, a positive significant relationship was determined between the school attachment variable and the science and mathematics achievements of the students. In the analysis, as the sub-dimensions of school attachment were evaluated, there was a significant relationship between the teacher variable, among the school, teacher, and peer sub-dimensions, and science achievement. As in science achievement, a positive relationship was determined between mathematics achievement and the teacher sub-dimension, which is among the sub-dimensions of school attachment.

The studies in the literature demonstrate similarity with these results of the research. Roeser et al. (1996) define the school attachment as, “the individual’s thinking that s/he is valued, supported and respected in the school s/he is a member of, feeling belonging to the school." There are even studies suggesting that school attachment has a positive relationship with science achievement and academic achievement even consisting of science and mathematics achievement. For instance, in a study, Aydın (2017) determined that the feeling of belonging to school is a significant predictor of science achievement of the student. In the studies, it was determined that school attachment increased academic achievement consisting of science and mathematics achievement (McMahon et al., 2008; Anderson, 2010; Özdemir et al., 2010; Duru and Balkıs, 2015; Sarı et al., 2017). As a result of these studies, it can be remarked that there is a positive relationship between the status of school attachment and science and mathematics achievement.

Wang and Holcombe (2010) found that the perceptions of seventh-grade students on school characteristics and their feelings of identification with the school influence using the self-regulation strategies in eighth grade and thus their academic achievement status. Bryan et al. (2012) determined that there was a positive relationship between school attachment and academic achievement. In addition, in another research, it is suggested that there is a significant relationship between academic achievement level and school attachment (Altuntaş and Sezer, 2017). As it was mentioned before, academic achievement is a factor that includes science and mathematics achievement. For this reason, it can be referred that the feelings of school identification and school attachment are related to achievement in science and mathematics.

In the research, it was concluded that the school attachment status of socioeconomically disadvantaged students has a positive significant relationship with their science and mathematics achievements. According to this result, it may be important for the socioeconomically disadvantaged students in terms of their achievement levels in science and mathematics for the school administration to establish school rules that include effective and fair discipline by ensuring the participation of students and organizing extracurricular sports activities, and academic or social activities. In addition, teachers’ behaving positive and emotionally supportive may be beneficial in terms of teachers’ encouraging their students to succeed and empathizing with their students to improve their science and mathematics achievements.

Research and publication ethics statement

The paper has complied with research and publication ethics.

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