



Assessment of Executive Functioning and Social Emotional Learning among Adolescents

Ergenlerde Yürütücü İşlevsellik ve Sosyal Duygusal Öğrenmenin Değerlendirilmesi

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ABSTRACT

Executive functions form a foundation for self-regulation and help adolescents build social-emotional skills, which help them manage their thoughts, behavior, and emotions and help prepare for a better transition to learning. The purpose of study was to assess the executive functioning skills and social emotional learning among adolescents. The cross-sectional study was conducted with a total 240 adolescents with a mean age of 15 ± 2.23 years, of whom 54% (130) were female and 46% (110) were male and participants completed socio-demographic form, behavior rating inventory for executive functioning and Social Emotional Learning Scale. The main findings were that female students were found to have greater social awareness skills (Mean \pm SD, 15 ± 2.01) and male students were found to have greater responsible decision-making skills (Mean \pm SD, 19 ± 2.28). A statistically significant positive correlation was found for shift ($r=0.159$), emotional control ($r= 0.187$) and working memory ($r=0.118$) of executive functioning skills with social emotional learning. The findings of the study showed that there is a relationship of the executive functioning skills and social emotional learning in adolescents, especially in relation to shift, emotional control and working memory of the executive functioning skills and social emotional learning among adolescents. Adolescents who have better executive functioning skills may acquire knowledge easily, perform better academic performance and attitudes to achieve personal goals.

Keywords: executive functions, social emotional learning, adolescents, education

ÖZ

Yürütücü işlevler öz düzenleme için bir temel oluşturarak, ergenlerin düşüncelerini, davranışlarını ve duygularını yönetmelerine, öğrenme için daha iyi bir geçiş hazırlığı yapmalarına ve sosyal-duygusal beceriler geliştirmelerine yardımcı olur. Bu çalışmanın amacı, ergenler arasında yürütücü işlev becerileri ile sosyal duygusal öğrenmeyi arasındaki ilişkiyi incelemektir. Kesitsel olarak gerçekleştirilen çalışmaya 130 (54%) ve 110 (46%) erkek olmak üzere toplam 240 ergen katılmış ve katılımcılardan veriler Sosyo-Demografik form, Yürütücü İşlevlere Yönelik Davranış Değerlendirme formu ve Sosyal Duygusal Öğrenme Ölçeği kullanarak elde edilmiştir. Bulgular, kız öğrencilerin daha fazla sosyal farkındalık becerilerine sahip olduğu ve erkek öğrencilerin daha sorumlu karar verme becerilerine sahip olduğu göstermiştir. Yürütücü işlev becerilerinin sosyal duygusal öğrenme ile yer değiştirme ($r=0,159$; $p= 0,021$), duygu kontrolü ($r= 0,187$; $p= 0,017$) ve çalışma belleği ($r=0,118$; $p= 0,032$) arasında anlamlı pozitif korelasyon bulunmuştur. Çalışmanın bulguları, ergenler arasında özellikle kaydırma, duygusal kontrol ve çalışan bellek gibi yürütücü işlev fonksiyonları ve sosyal duygusal öğrenme arasında ilişki olduğunu göstermiştir. Daha iyi yönetici işlev becerilerine sahip olan ergenler, kişisel hedeflere ulaşmak için daha kolay bilgi edinebilir, daha iyi akademik performans ve tutum sergileyebilir.

Anahtar sözcükler: yürütücü işlevler, sosyal duygusal öğrenme, ergenler, eğitim

Introduction

One of the main purposes of education is to provide the necessary education to be social and experienced by communicating with the social environment of an individual. Therefore, the only achievement that needs to be acquired through education is not academic qualifications, but the structuring of social relations along with emotional developments. In addition to the academic development of students, the necessity of supporting their social and emotional development stated in the literature (General et

al. 2018). Especially adolescents may need social and emotional help as they explore the opportunities and learn many new things. But they may encounter behavioral and health problems as they try to learn new things without social and emotional help which may be resulted most of time negative consequences.

Emotional Learning (SEL) method is one of the ways for individuals to help them to increase their self-awareness, self-management, social awareness, relational skills, and responsibility decision making skills (Corcoran et al. 2018). Although the emphasis is

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on practices aimed at increasing academic skills in education, the contribution of SEL skills has been empirically demonstrated by many studies (Lee et al. 2013). The studies also reported that it is necessary to have relevant skills in order to be successful not only in school but also in other areas of life over the lifespan (Grant et al. 2017). The results of the studies showed that SEL skills increased the academic success of the students, made the classroom-school climate more interesting and contributed to the development of skills such as cooperation, creativity, communication, and critical thinking (Basu and Mermillod 2011, Domitrovich et al. 2017). The consistencies in previous research regarding SEL also reported that SEL increases motivation and interest in school, develops the ability to establish positive relationships with the environment, develops social and problem-solving skills, increases the sense of commitment to school, and reduces negative behaviors among adolescents (Durlak et al. 2011, Gunter et al. 2012).

Executive functions are skills from brain processes that enables individual for planning, organizing, maintaining attention, gathering information, inhibiting response, and shifting strategies (Diperna and Volpe 2005). Executive functions and social/behavioral functioning work together to understand the events that happens in adolescents' life. Executive function is the management of multiple pieces of information and cognitive processes include thoughts and actions, remember, and recall information. Executive functioning skill is affects everyday functions such as productivity and regulates how adolescent interact and engage with other people in the classroom. There are factors to effect of development of executive functioning skills at any given age. Executive functioning skills transition may show difference from child age to adulthood. Aging, maturity, interventions, social support, and school environment play a significant role the relationship between academic and social lives among adolescents (Oberle et al. 2016).

Although biological and environmental factors found to be principal factors of developing executive functioning skills it may improve with practice in children and adolescents (Willoughby et al. 2010). When various executive functioning skills are required to learn in the classroom, it is necessary to consider how social and emotional learning affected with executive functioning skills among adolescents. While many studies explored the social emotional learning among different age groups, the relationship between executive functioning and SEL among adolescent are immature (Jones and Bouffard 2012, McCormick et al. 2015). This study contributes to a better understanding of the link between executive functioning, social emotional learning among adolescents.

Method

Sample

This research was carried out in quantitative and cross-sectional models. The universe of the study consists of 240 students the aged of 12-18 years old from 10 different high schools in Nevşehir province Ürgüp district. The schools and participants

were chosen randomly. A total of 262 students participated in the study, 14 students left without completing the questionnaires and scales, and 8 students were not included in the number of data analysis because they did not comply with the conditions of admission to the study. The data from the participants were obtained through questionnaires and scales, it was carried out with random sampling. Inclusion criteria for participation in the study are, being in the 12-18 age range, not having any psychiatric or chronic disease, and voluntarily agreeing to participate in the study. Participants who did not meet these criteria were not included in the study. Parent and participant consent forms were obtained from the volunteers participating in the study.

This study included 240 students the aged of 12-18 years old and enrolled in high schools. 130 (54%) of them were female and 110 (46%) of them were male with a mean age of 15 ± 2.23 years. 173(72.1%) of them were from low-income and 67(27.9%) of them were from high-income status. All participants were from the schools in Ürgüp/Nevşehir. Alpha error was taken as 5% and beta error as 10% in the sample size calculated using G^* power analysis, and the differences between the variables were determined because of the statistical analysis. Thus, sample size determined as 240.

Procedure

The written informed consent form signed from parents and all participants before entering the study. This study obtained ethical approval from Kapadokya University Ethics Committee with the date of 10.05.2022 and the protocol number of 29533901-050.99-15479.

Questionnaires and scales applied to the participants were carried out by the researcher through face-to-face participation. All participants filled out the socio-demographic form, BRIEF-P for executive functioning and Social Emotional Learning Scale. Executive functioning measures obtained by completing BRIEF-P which provided information subdimensions of inhibit, shift, emotional control, working memory, plan/organize, metacognition, flexibility, inhibitory self-control and BRIEF-P Global. Social emotional learning scale used to gather information subdimensions of self-awareness, social awareness, self-management, relationship skills and responsible decision-making.

Measures

Socio-demographic form

The form containing the socio-demographic information of the participants consisted of questions such as age, gender, socio-economic level, number of siblings, mother's education level, and father's education level.

Executive Functions Behavior Rating Inventory (BRIEF-P)

The BRIEF-P is a rating system to examine the executive functioning skills in children (Gioia et al. 2002). The scale Turkish adaptation was conducted by Batan et al (2011). Alpha levels were found to be changing between .60 and .94 (Batan et al., 2011).

The scale has eight subdomains such as inhibit, shift, emotional control, working memory, plan/organize. This measurement has two validity scales such as inconsistency and negativity. The BRIEF provides a good measurement of parents' assessment of their children's everyday executive behaviors in natural settings (Gioia et al. 2002). The parents rate their children upon five areas of executive functioning (inhibit, shifting, emotional control, working memory, and planning/organizing), two melded areas of functioning (metacognition and behavioral regulation), and global executive functioning (a combination of all five 54 singular scales). The Inhibitory Self-Control Index is composed of the Inhibit and Emotional Control scales. The Flexibility Index is composed of the Shift and Emotional Control scales. The Emergent Metacognition Index is composed of the Working Memory and Plan/Organize scales. The parent completes this measurement, and it provides a good picture of the child's behavior. The rating scale value for the child is 30 and 99 where scores below 65 are in the average range; between 65 to 70 are in the at-risk range; 71 and higher are clinically significant. Cronbach alpha was found .97 which is very high range for BRIEF-P. Gioia et al. (2002) found internal consistency within the high range ($\alpha = .80$ to $.98$) for all scales. The Cronbach's alpha was found .87 for current study.

Social-Emotional Learning Scale

Totan (2018) developed the scale to measure social emotional learning skills in adolescents. It consists of 23 items and five sub-dimensions in 5-point Likert type. The lowest 23 and the highest 115 points can be obtained from the scale, and there is no reverse scored item. The sub-dimensions of the scale are self-awareness, social awareness, self-management, relationship skills and responsible decision-making, and it also has a short five-item form. During the development of the scale, exploratory and confirmatory factor analysis was performed on the data obtained from 905 adolescents (middle school and high school students). Considering the factor loads of the items in the dimensions of the scale; the self-awareness dimension was between .47 and .81; the dimension of responsible decision making is between .46 and .84; It was observed that the self-management dimension ranged between .60 and .75, the relationship skills dimension varied between .47 and .75, and the social awareness dimension varied between .51 and .77 (Ağırkan 2021). Within the scope of the reliability studies of the scale, the Cronbach Alpha coefficient calculated for the whole test found to be .92 for the long form and .79 for the short form (Ağırkan 2021). The Cronbach Alpha coefficients calculated for the sub-dimensions are .76 for the self-awareness dimension; .83 for the responsible decision-making dimension; .73 for the self-management dimension; .74 for the relationship skills dimension and .70 for the social awareness dimension (Ağırkan 2021). In this study, the Cronbach Alpha coefficient was calculated as .82.

Statistical Analysis

All statistical analysis were carried out using SPSS 24.0 package program. In the data analysis, descriptive statistics provided information in Table 1. Table 2 illustrated relationship between executive functioning and SEL scale scores using the Pearson

correlation coefficient test. In order to figure out the relationship of independent variables of BRIEF-G subdimension such as inhibitory self-control, flexibility, metacognition, inhibition, shift, emotional control, working memory, and planning/organization and dependent variable as social emotional learning, Pearson correlation test was conducted. Linear regression analysis was performed on whether the measures of independent variables of executive functioning skills such as inhibitory self-control, flexibility, metacognition, inhibition, shift, emotional control, working memory, and planning/organization predict dependent variable of social emotional learning among adolescents. It allowed to determine contribution of each aspect of measured executive functioning skills and each measure of SEL.

Results

Table 1 shows the socio-demographic characteristics, executive functioning, and social emotional learning results. A total of 240 adolescents, with a mean age of 15 ± 2.23 years, of whom 54% were female and 46% were male. Considering the grade levels, 92 (38.3%) were in 9th grade, 42 (17.5%) were in 10th grade, 58 (24.1%) were in 11th grade and 48 (20.1%) were in 12th grade. The students performed on average SEL-total with a mean of 131 ± 14.83 and BRIEF-total with a mean of 176 ± 27.74 . Descriptive results indicated that EF ($\bar{x} = 52$; $SS = 13.4$) and SEL ($\bar{x} = 75$; $SS = 15.7$) levels are moderate. Among the dimensions of executive

Table 1 Socio-demographic Characteristics, Executive Functioning and SEL Results

	Total (N=240)
Female (%)	54
Male (%)	46
Years of age (mean \pm SD)	15 ± 2.23
Self-awareness (mean \pm SD)	28 ± 2.32
Social awareness (mean \pm SD)	15 ± 2.01
Self-management (mean \pm SD)	32 ± 2.88
Relationship skills (mean \pm SD)	22 ± 3.11
Responsible decision-making (mean \pm SD)	19 ± 2.28
SEL-Total	131 ± 14.83
BRIEF-P Global	16 ± 2.63
Inhibitory Self-Control (mean \pm SD)	14 ± 3.28
Flexibility (mean \pm SD)	36 ± 4.25
Metacognition (mean \pm SD)	20 ± 2.83
Inhibition (mean \pm SD)	29 ± 2.57
Shift (mean \pm SD)	24 ± 2.94
Emotional Control (mean \pm SD)	9 ± 3.42
Working Memory (mean \pm SD)	11 ± 3.18
Planning/Organization (mean \pm SD)	17 ± 2.64
BRIEF-Total	176 ± 27.74
SEL: Social Emotional Learning, BRIEF-P: Executive Functions Behavior Rating Inventory	

functioning skills, the lowest score was found 5 and highest was 36. For SEL, the lowest score was 37 and the highest score was 126. In the arithmetic mean calculations were made according to the total scores. In terms of the highest score obtained in the analysis made according to the total scores in the scale dimensions, in the dimension of self-awareness (\bar{x} = 11.4; SD = 2.29; 81.7%) and the self-management (\bar{x} = 19.4; SD = 8.32; 81.3%) were found.

Table 2 demonstrated the participants' executive functioning results and their correlations with the total scores of social emotional learning. Female students were found to have greater social awareness skills and male students were found to have greater responsible decision-making skills in the present study. Self-management skill (mean \pm SD, 32 \pm 2.88) and self-awareness skill (mean \pm SD, 28 \pm 2.32) were also found to have a higher score than other social emotional learning skills. Social-awareness skill (mean \pm SD, 15 \pm 2.01) was found a lowest score among all the skills.

Table 2 Executive Functioning Test Results and Their Correlation with the Total Scores of SEL

Executive functioning subdimensions	Pearson's r correlation with total scores of SEL	p value
BRIEF-P Global	-0.07	0.25
Inhibitory Self-Control	0.88	0.36
Flexibility	0.11	0.85
Metacognition	0.38	0.73
Inhibition	0.74	0.22
Shift	0.15*	0.02*
Emotional Control	0.18*	0.01*
Working Memory	0.11*	0.03*
Planning/Organization	0.029	0.88
SEL total	-0.195	0.33

*p<0.05, SEL Total: Social Emotional Learning Total Score, BRIEF-P: Executive Functions Behavior Rating Inventory

Pearson correlation coefficient test results indicated that a statistically significant positive correlation was found for shift ($r=0.159$; $p= 0.021$), emotional control ($r= 0.187$; $p= 0.017$) and working memory ($r=0.118$; $p= 0.032$) with social emotional learning. No other executive functioning skills were significantly correlated with SEL. The correlation of inhibitory self-control ($r= .88$) and inhibition ($r= .74$) subdimension in the executive functioning skills are higher than other dimensions. Conversely, planning/organization ($r= 0.029$) and flexibility ($r= 0.11$) are lower than other dimensions. The results also indicated that there is a negative correlation between SEL total scores ($r=-0.198$) and executive functioning subdimensions.

After conducting Pearson correlation test for independent and dependent variables, the result revealed that only shift, emotional control, and working memory of executive functioning skills found to be significantly correlated with social emotional learning. To better understand how dependent variable, social emotional learning, variable has changed with changes in the independent variables of executive functioning skills of as inhibitory self-control, flexibility, metacognition, inhibition, shift, emotional control, working memory, and planning/organization. Table 3 indicated multiple regression analysis to determine the effect of executive functioning skills on SEL. The results showed that metacognition and working memory were the dimensions found statistically significant. These results are shown in table 3, metacognition ($b= .542$, $p= .001$) and working memory ($b= .386$, $p= .001$) which are the subdimensions of executive functioning skills affect SEL, no other dimensions have effect on SEL. Beside the subdimension of executive functioning skills, age ($p=.327$) and gender ($p=.644$) were not found statistically significant with SEL (Table 3). Although Pearson correlation coefficient test results indicated that a statistically significant positive correlation was found for shift ($r=0.159$; $p= 0.021$), emotional control ($r= 0.187$; $p= 0.017$) and working memory ($r=0.118$; $p= 0.032$) with social emotional learning. Regression analysis showed that metacognition and working memory were statistically significant with SEL.

Table 3 Findings on the Comparison of Executive Functioning and Social Emotional Learning

Dependent variable	Independent variables	B	SE	t	p
	Age	.658	.207	2.44	.327
	Gender	.341	.375	1.63	.644
SEL	BRIEF-P Global	.452	.358	1.5	.915
	Inhibitory Self-Control	-.276	.382	-.68	.366
	Flexibility	-.185	.725	.75	.274
	Metacognition	.542	.252	.22	<.001
	Inhibition	-.367	.121	-.85	.428
	Shift	-.628	.425	-.49	.108
	Emotional Control	-.307	.173	-.87	.294
	Working Memory	.386	.288	.66	<.001
	Planning/Organization	-.288	.581	.55	.267

SEL: Social Emotional Learning, BRIEF-P: Executive Functions Behavior Rating Inventory

Discussion

The purpose of this study was to assess executive functioning skills and social emotional learning (SEL) among adolescents. Recently, the great interest in the studies of social emotional learning has become important due to its contribution to students' academic performance and success in their school life. Executive functioning skills are the mental processes that enable students to plan, focus attention, remember instruction, and complete multiple tasks successfully (Gordon et al. 2018, Pascual et al. 2019). The studies investigated involvement of SEL in all facets of educational life among different age group of students (Bierman et al. 2008, Gerst et al. 2017). The literature provides numerous examples of SEL programs that improve students' academic involvement and performance in the classroom (Caldarella et al. 2009, Domitrovich et al. 2017). Some studies conclude that SEL programs also reduce behavioral and psychological problems while it increases classroom participation and learning interest towards to lessons (Barry et al. 2017, Rose et al. 2011). Therefore, educational programs are adjusted based on SEL approaches to increase students' learning ability and skills. It is also stated by many authors SEL is integral part of education and students' development where the students acquire and apply the knowledge, skills, and attitudes to develop personal and academic goals (Huizinga et al. 2018). It is important to note that SEL is dependent upon executive functioning and this both skills are connected.

The studies also indicated that gender plays an important role in SEL skills (Goldberg et al. 2018, Sklad et al. 2012). Female students were found to have greater relationship skills while male students were found to have greater self-management skills (Pinto and Raimundo 2016). Characteristics such as age, gender, socioeconomic status, and physical fitness can act as moderators in the relationship between executive functions and academic performance, as shown in previous research (Thomson 2018, Kvalø et al. 2019). But age and gender were not found to be statistically significant with social emotional learning in the present study. The consistencies in previous research regarding relationship skills in female students and self-management in male students found in the present study. Also, female students were found to have greater social awareness skills and male students were found to have greater responsible decision-making skills in the present study. The present study results are in line with previous research regarding social emotional learning skills which male students have a higher self-management skill to control their own emotions and behaviors (Tsubomi ve Watanabe 2017). However, social awareness and social behavioral skill scores are higher in female students than male students. The studies revealed that female students perceive and understand emotions better than male students that showed better cognitive and executive functioning for learning (Nouwens ve ark. 2017). But the inconsistencies in previous research reported that no differences in SEL skills found between female and male students (Willoughby et al. 2019).

The gap is evident in previous research regarding executive functioning skills and SEL among adolescents. When executive functioning skills consider of SEL among adolescents, it has been found that students who have a higher level of metacognition and working memory functioning performed better in SEL skills. The present study results showed that metacognition and working memory functioning found statistically significant and have effect on SEL on adolescents. On the other hand, the results revealed that statistically significant positive correlation as found for other executive functioning skills such as shift, emotional control and working memory. However, no other executive functioning skills were significantly correlated with SEL. There have been numerous studies that examine the SEL and executive functions for the different age groups (Berard et al. 2017, McKown et al. 2009). Bierman and Torres (2016) stated that promoting social and emotional development for all students in classrooms involves teaching and modeling social and emotional skills, providing opportunities for students to practice and hone those skills, and giving students the chance to apply those skills provide better executive functioning skills.

Similarly, Merrell et al (2008), concluded that working memory, inhibition and cognitive ability are the best predictor of academic performance which are related to greater adaptability for learning as well as work skills. Beside this, planning/organizational skills and cognitive flexibility becomes the most important executive functioning skills after the age of eleven (Wiebe 2011). Vandierendonck (2012) pointed out that there is relationship between age, executive functioning skills and academic performance. As the age produces changes that has impact on the executive functioning components and academic performance (Raver et al. 2008). This is because of the specific development of skills that is necessary for learning and school performance. The literature provides numerous examples of the importance of executive functioning in achieving academic performance and success (Huizinga et al. 2018, Willoughby et al. 2019). There is a recognized problem specific to learning process that is associated with a poor working memory and that prevents to perform better academic performance. Thus, it is important to conclude that if social emotional learning is the foundation for good academic performance, they are themselves related to the development of executive functioning.

Ursache et al (2012), found that executive functioning variables act differently when poorer learning occurred among students. Bernard and Walton (2011) concluded that working memory skills become more important than other skills when poorer reading performance observed between primary and secondary school students. The study by Aarnoudse-Moens et al (2012) revealed that development of academic skills is significantly correlated with inhibition, planning/organizational skills and working memory. Although many studies concluded that executive functioning is the variable with the most variance in explaining students' academic performance and learning the present study results indicated the importance of association between executive functioning skills and SEL among adolescents.

The results suggested that social emotional learning, which is a difficult subject to understand and implement in adolescence, can be supported with better executive function skills, and can provide assistance to adolescents in terms of academic and personal development. The results of this research support the findings that better executive functioning skills and working memory development is essential to achieve stability for school and academic success for adolescents. It is important to note that there have been numerous studies examined social emotional learning for different age groups, however, deficiencies detected in the executive functioning skills and social emotional learning among adolescents. The findings of this research contribute different insight and fulfill the gap in the literature. All this can contribute to the development of specific intervention plans for the executive function components and deficient capabilities that can guide efforts to improve the social emotional learning process for students.

This study was conducted only for the age group of 12-18 years old high school students in Ürgüp/Nevşehir city. Future research may consider including older students or adults' groups. Also, the data collected from 240 adolescents from the schools which were in Ürgüp/Nevşehir city. Therefore, the results of the study cannot be generalized. Future research may consider doing similar research in a larger group. Also, this study used pearson correlation and regression analysis for variables which was required to find out the relationship for each variable, but future research may consider doing structural equation modeling method to see the relationship in a single analysis. Thus, the amount of error caused by the measurement in the path analysis can be eliminated.

Conclusion

This study was assessed executive functioning skills and social emotional learning among adolescents. Due to the deficiencies detected in the literature regarding this topic, the results appeared promising and must be highlighted; the executive functioning skills have impact on SEL among students. The executive functioning skills significantly positively correlated with SEL and SEL programs reduced behaviors problems of the participants. Gender plays an important role in academic and behavioral success in SEL. Further studies need to be done regarding SEL programs and executive functioning skills among different age groups. More efforts should be made ensure the SEL programs is appropriate to increase better executive functioning skills for students.

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