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Examining the Relationship between Executive Function Skills and Grade Points of Pre-Service Preschool Teachers

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ABSTRACT

With executive function skills, individuals become aware of their own structure and learning characteristics. As a result of studies conducted with university students, it is thought that executive function skills and grade points are related. However, there is no study conducted with pre-service preschool teachers who will work in close relationships with children throughout their professional lives. Therefore, the aim of this study is to examine the relationship between executive function skills and grade points of pre-service preschool teachers. The data obtained from 540 university students face-to-face with consent form were analysed with SPSS software. It was found that there was no significant relationship between executive function skills and grade points regardless of grade level and according to grade level. In addition, while there was no significant difference in students' executive function skills according to grade level, a significant difference was found in students' grade points.

KEYWORDS

Pre-service preschool teachers; executive function skills; grade points; grade level.

INTRODUCTION

Executive cognition is the individual's awareness of his/her own cognitive structure and learning characteristics. While cognition provides understanding and awareness for anything, executive cognition provides both understanding and awareness and knowing how to learn (Dilci, 2014). Executive cognition consists of three main components that are working memory, inhibitory control and cognitive flexibility (Miyake et. al., 2010). A comprehensive study searching literature review in detail stated that it includes twelve components as response inhibition, working memory, emotional control, task initiation, sustained attention, planning, organization, time management, flexibility, metacognition, goal-directed persistence and stress tolerance (Ora et. al., 2018).

People who can effectively regulate their behaviours, emotions and thoughts according to their priorities and needs are more aware of their own abilities and can better identify the standards necessary to improve their performance. At the same time, students who are not aware of their abilities may be less willing to participate in academic processes by being disappointed in the face of the difficulties they face (Duru et al., 2014). It can be thought that students who are aware of their own abilities have higher academic achievement. For example, reading comprehension was directly related to executive function skills (Kieffer et. al., 2013). Generally, it was found that speaking, listening, reading, writing and math performance increase as a result of executive function skills (Holmes & Gathercole, 2014).

Distefano et. al. (2020) stated that neuroscience studies focusing on reading, math, social and emotional skills are important for education, executive function skills play more important role in learning because there is a significant connection between seven life skills including focus and self-control, perspective-taking, making connections, communicating, taking on challenges, critical thinking and self-directed engaged learning, and executive functions. Thus, executive function has a crucial role in students' academic success because academic success requires the ability to plan, organize and prioritize information, monitor own progress, reflect on own work, and manipulate information in working memory (Priyadarshini & Thangarajathi, 2017). When students employ effective strategies and achieve academic success, a self-reinforcing cycle begins. This success boosts their motivation, prompting increased effort, more strategic learning, and ongoing academic achievement. Their persistence ultimately enhances their academic performance (Meltzer et. al, 2014). Zelazo et. al. (2016) mentioned about that trainings on executive functions can cause the improvements in performance on certain tasks by changing the brain. It means that academic performance can be improved by strengthening executive functions.

In a study conducted by Ahmed et. al. (2019), it was found that only predictor of the academic achievement of students that are 15 years old is executive function skills after demographic and home environment variables are controlled. At the same time, a study that children between the ages of 6 and 15 years participated in resulted that executive function

skills can be effective on academic achievement (Lawson & Farah, 2017). The same result was found in another study conducted with children aged 6-11 (Thorell et. al., 2013). A study including high school students (Shabanzade et. al., 2022) also supports these findings. In a study conducted by Samuels and his colleagues (2016), it was found that academic performance in later secondary school grades can be reliably anticipated by executive function skills scores measured during the early middle grades. In the study of Morgan and his colleagues (2018), the executive functions predicted their second-grade academic achievement and behaviour. In another example, Ekenel's study (2005) stated that there was a significant relationship between the mathematics course success of senior high school students and their evaluation and planning skills, which are included in metacognitive learning strategies.

There are also studies conducted with university students that examine the relationship between executive function skills and awareness of abilities in general and academic achievement. Vadhan and Stander (1994) found that academic achievement of university students increased in direct proportion to their executive function skills. Another studies with university students (Chavez-Hernandez, 2023; Marti et. al., 2023) support these findings. In Akin's (2006) study, it was found that the metacognitive awareness of university students with positive academic achievement perception was high. In a study conducted by Duru, Duru, and Balkis (2014) with university students, it was observed that students' self-regulation skills were positively related to their academic achievement. These two studies are important because because executive function is related to metacognitive awareness. In a study conducted by Sokmen (2013) with classroom teaching students, no significant difference was found between students' executive function levels according to gender and grade level variables, while a positive relationship was found between their academic GPAs. In other words, as students' executive function levels increased, their academic achievement also increased.

Although there are many studies examining the relationship between executive function skills of university students and their academic achievement (Akin, 2006; Duru et al., 2014; Sokmen, 2013; Vedhan & Stander, 1994;) or studies on the metacognitive awareness (Baba Ozturk & Gural, 2016) and metacognitive awareness (Ozkan & Yildiz, 2023) of pre-service preschool teachers, there is no study on the executive function skills of Pre-School Teaching Department students who will work with children throughout their professional lives. However, executive function skills may have an important role in combating job stress when working with children. For example, teachers with a high degree of short-term memory may be more positive in recalling and managing information and may have more effective behaviour management strategies. Teachers with high inhibition control are less automatic to use adaptive behaviours based on cognitive and more effective strategies. Finally, teachers with better cognitive flexibility may be more effective in maintaining awareness and control of the whole class in dealing with a misbehaving child. Teachers with low executive function skills may respond automatically by raising their voice to a child who is causing chaotic classroom atmosphere and teacher stress, while teachers with high executive function skills may intervene by talking to the

same child or removing them from the activity. These teachers may have better classroom management and use more planned, purposeful instructional strategies (Friedman-Krauss et. al., 2014). Thus, high executive function skills can be seen as a protective factor for teachers to cope with the stress caused by children's behaviour (Raver et al., 2012). In a study conducted with kindergarten teachers working in Head Start schools, it was found that having high executive function skills was associated with teachers' ability to cope with job stress caused by children's behaviour problems (Friedman-Krauss et. al., 2014). Therefore, university instructors should also help students develop executive function skills (Dilci, 2014).

Academic achievement is generally seen as the success in a school. Getting a rank, achieving different successes with some abilities or obtaining a grade can be accepted as academic achievement. However, looking at the studies (Akin, 2006; Duru et. al., 2014; Sokmen, 2013; Vedhan & Stander, 1994), the academic achievement of students was shown with their grade points in investigating the relationship between university students' executive function skills and academic achievement. In other words, their grade points used rather than their academic achievements were taken into consideration in order to understand their executive function skills. Therefore, the purpose of this study is to examine whether there is a significant relationship between executive function skills and grade points of pre-service preschool teachers according to and regardless of their grade levels. Moreover, the answers to the following questions were solved.

1-Do students' executive function skills change according to their grade level?

2-Do students' grade points change according to their grade level?

METHODS and MATERIALS

The aim of this study is to examine the relationship between executive function skills of pre-service preschool teachers and their grade points. In this respect, the research is in the relational survey model. The survey model is "research in which the views, interests, skills, abilities, attitudes, etc. of the participants on a subject or event are determined" (Buyukozturk et al., 2008, pp. 177-178). The relational survey model is a survey model in which two or more variables are compared or the relationships between them are determined (Karasar, 2007). In this study, the relationship between students' executive function skills and their grade points is examined.

Participants

540 female university students from the second, third and fourth grades in the Department of Preschool Teaching in Istanbul participated in this study. Because there is no male student in the department, all of participants are female. Among the students, 140 were second-year students, 140 were third-year students and 300 were fourth-year students. While, 138 students are from the districts in low socio-economic level, 201 students are from the districts in middle socio-economic level. The rest of students are from high socio-economic level. Convenient/accidental sampling method was used as the sampling method (Buyukozturk et. al.,

2016). In this study, the researcher completed the study by reaching the most easily accessible respondents.

Data Collection Tools

The students' grade level and academic average information were obtained, and data were collected using the Executive function skills Scale in 5-point Likert form developed by Altindag (2008). This one-dimensional scale, which was initially created as 55 items, was reduced to 30 items by applying it on 239 students in Educational Faculty. According to the reliability analysis results obtained from the scale, Cronbach Alpha was found to be .94.

Data Collection

Firstly, students were asked for if they were volunteers, and they filled in consent form. Then, they completed the Executive Cognition Skills Scale face-to-face. Each student filled it about 10 minutes.

Data Analysis

IBM SPSS Statistics 22.00 program was used for data analysis. According to the results of the reliability analysis of the Executive Function Skills Scale for the current study, Cronbach Alpha was found to be .806. Accordingly, the scale is quite reliable (Can, 2016). The kurtosis and skewness coefficients were examined to determine the appropriate analysis method to be used with the obtained data. According to the results of the normality test for the students' grade level, executive function skill scores and grade points, it was determined that the distribution was not normal because the kurtosis and skewness values were not between -1.96 and +1.96 (Can, 2016). Since the data were not normally distributed, Spearman's Rho Test was used for the relationship between students' executive function skills and grade points, and Kruskal-Wallis Test was used to see the effect of students' grade level on their executive function skills and grade points.

RESULTS

The findings of the study are presented in tables. Table 1 shows the results of Spearman's Rho correlation analysis for students' executive function skills and grade points.

Table 1.

Spearman's Rho Correlation Analysis Results for Executive Function Skills and Grade Points

Grade Level	rs	p
2nd Grade	0.280	0.166
3rd Grade	-0.248	0.197
4th Grade	0.014	0.472
Total	0.119	0.187

According to Table 1, no statistically significant relationship was found between executive function skills and grade points of second-grade students (p=.166>.05), third-grade

students (p=.197>.05) and fourth-grade students (p=.472>.05). There was also no statistically significant relationship between executive function skills and grade points of all students regardless of grade level (p=.187>.05).

Table 2 shows the results of the Kruskal-Wallis Test for students' executive function skills according to grade level.

Table 2.

Kruskal-Wallis Test Analysis Results for Students' Executive Function Skills by Grade Level

Grade Level	N	Mean rank	Chi-square	df	p
2nd Grade	140	26.14	2.704	2	.259
3rd Grade	140	35.79			
4th Grade	300	28.13			

According to the values in Table 2, the difference between students' executive function skill scores according to their grade level was not statistically significant (p=.259>.05). Looking at the mean ranks, executive function skill scores belong to third, fourth and second grade students, respectively, from high to low.

Table 3 shows the results of the Kruskal-Wallis Test for students' academic achievement by grade level.

Table 3.

Kruskal-Wallis Test Analysis Results for Students' Grade Points by Grade Level

Grade Level	N	Mean rank	Chi-square	df	p
2nd Grade	140	15.43	13.105	2	.001
3rd Grade	140	35.96			
4th Grade	300	33.05			

According to the values in Table 3, there is a statistically significant difference between the grade points of the students according to their grade level (p=.001<.05). When the mean ranks are examined, the grade points of the students belong to the third, fourth and second grade students, respectively, from high to low.

DISCUSSION

There was no statistically significant difference between executive function skills and grade points of students studying in the Department of Preschool Teaching according to and regardless of their grade level. In the study conducted by Altindag (2008), no significant difference was found between the executive function skills and grade points of Faculty of Education students at first and fourth grades. On the contrary, Vadhan and Stander (1994) found a significant positive relationship between academic achievement and executive function skills of university students. There are a lot of studies supporting Vadhan and Stander’s (1994) study. For example, the similar results were found in the studies conducted by Ahmed and his

colleagues (2019), Chavez-Hernandez (2023), Lawson & Farah (2017), Marti and his colleagues (2023), Morgan and his colleagues (2018), etc. Moreover, In Akin's (2006) study, it was found that university students with a positive perception of academic achievement had high levels of metacognitive awareness. In the study conducted by Duru et. al. (2014) with university students, it was seen that students' self-regulation skills were positively related to their academic achievement.

The reason for this difference may be that the participants of the current study did not have similar demographic characteristics. In other words, there may be another factor examining the relationship between students' executive function skills and their grade points.
No significant difference was found between the executive function skills of students studying in the Department of Preschool Teaching according to their grade level. In Sokmen's (2013) study, no significant difference was also found between the executive cognition levels of Classroom Teaching students according to their grade level. On the contrary, in the study conducted by Altindag (2008), a significant difference was found between the executive function skills of the Faculty of Education students in the first and fourth grades in favour of the fourth grades. As can be seen, in contrast to the study that supports the current study, there are also studies that do not support it. This difference may be due to the existence of other factors such as intelligence level that affect the executive function skills of the students participating in all studies but in fact, this result found by this study can be an accepted result because the ages of students generally increase as their grade levels increase but executive function skills does not change significantly from childhood to adulthood. For example, a study stated that working memory that is a component of executive function at 54 months predicts working memory at 15 years of age (Ahmed et. al., 2019).

A significant difference was found between the grade points of students studying Preschool Education according to their grade level. Although it could not be analysed which grade levels this difference was between due to the non-homogeneous distribution of the groups, it was seen that the grade points of the students were in the third, fourth and second grade students, respectively, from high to low. In addition, in Sokmen's (2013) study, it was also observed that as the grade level of Classroom Teaching students increased, their academic GPAs also increased. In the study of Cankaya and Dag (2017), the analysis revealed a marked disparity in average exam scores among subjects across various grade levels: Turkish, mathematics, and life sciences from first to third grades, and mathematics, social sciences, physical sciences, and English in the fourth grade. In another study conducted by Savas (2009), the results showed that grade level has an important role on students’ motivational beliefs by learning, mastering and showing their abilities in science course.

CONCLUSION

In this study, while the grade points of preschool teacher candidates changed, their executive function skills did not change according to their grade levels. The reasons for these two results

can be investigated in next studies. Moreover, instructors should consider the effect of grade level on students' grade points and carry out the educational process according to the grade level.

This study found that there was no relationship between the executive function skills and grade points of students. It is an interesting result because previous studies found opposite findings generally. Therefore, other factors that may affect executive function skills and grade points can also be included in next studies. For example, only female studies were included in this study. The study can be repeated by including male students. In addition, first grade students were not included in the study. In order to determine the significant difference between students' executive function skills and grade points according to grade level, first graders can also be included in the study.

This study's sampling method used in this study can negatively affect the generalizability of the data. In future studies, the sample can be determined by using random sampling methods. In this way, more generalizable results can be obtained.

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