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| Research Article / Araştırma Makalesi |

The Relationship Between Metacognition and AcademicAchievement in Adolescents: The Mediating Role of Academic Self-Control

Ergenlerde Üstbiliş ve Akademik Başarı Arasındaki İlişki: Akademik Öz Kontrolün Aracı Rolü

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Keywords

1. Metacognition
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Abstract

Purpose: The purpose of this study was to investigate the correlations between metacognition, academic self-control (ASC), and academic achievement among adolescents who attend secondary and high school and to test the mediating role of ASC in the correlation between metacognition and academic achievement.

Design/Methodology/Approach: The investigation was carried out using a correlational research approach. The sample group consisted of 572 adolescents (M = 14, SD = 1.28), who were aged between 11 and 17 years and studying in secondary and high schools in two cities in Türkiye. Demographic Questionnaire, Academic Self-Control Scale, and Metacognitive Awareness Inventory for Children were used in the study. The Jamovi V 2.2 software was utilized to analyze the data.

Findings: The Pearson correlation analysis showed that metacognition was positively associated with ASC and grade point average (GPA). Academic self-control was also positively correlated with GPA, as well. Moreover, the results of the current research demonstrated that the direct and indirect effects of metacognition on academic achievement were significant, and ASC played a partial mediating role in this correlation.

Highlights: The study's findings were discussed within the frame of the related literature, implications for theory were drawn, and suggestions for future studies were offered.

Öz

Çalışmanın amacı: Bu araştırmada ortaokul ve lisede öğrenim gören ergenlerin üstbiliş, akademik öz-kontrol ve akademik başarıları arasındaki ilişkilerin incelenmesi ve üst biliş ile akademik başarı arasındaki ilişkide akademik öz-kontrolün aracı rolünün test edilmesi amaçlanmıştır.

Materyal ve Yöntem: Araştırma ilişkisel tarama modeline göre yürütülmüştür. Araştırma grubunu yaşları 11 ile 17 arasında değişmekte olan Türkiye'nin iki farklı şehrinde ortaokul ve lisede öğrenim gören 572 (M = 14, SD = 1.28) ergen oluşturmaktadır. Araştırmada Demografik Bilgi Formu, Akademik Öz-Kontrol Ölçeği ve Üst Bilişsel Fakındalık Ölçeği kullanılmıştır. Araştırma verilerinin analizinde jamovi V 2.2 paket programı kullanılmıştır.

Bulgular: Verilere uygulanan pearson korelasyon analizi neticesinde, üst bilişin akademik öz-kontrol ve GPA ile pozitif yönde ilişkili olduğu sonucuna ulaşılmıştır. Akademik öz-kontrolün de GPA ile pozitif ilişkili olduğu görülmektedir. Ayrıca araştırma sonucunda üst bilişin akademik başarı üzerindeki doğrudan ve dolaylı etkilerinin anlamlı olduğu ve akademik öz-kontrolün bu ilişkide kısmi aracı rolü olduğu görülmüştür.

Önemli Vurgular: Araştırmanın bulguları ilgili literatür çerçevesinde tartışılmış, kuramsal çıkarımlar elde edilmiş ve ileride yapılacak araştırmalara yönelik öneriler sunulmuştur.

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INTRODUCTION

Since societies today consider adolescence a preparatory process for professional life in adulthood, academic achievement is an essential issue in this period (Rana & Mahmood, 2010; Steinberg, 2007). According to a theoretically based definition, academic achievement is a concept that consists of factors such as the acquisition of skills and competencies, satisfaction, perseverance, achievement of learning goals, and career success (York, 2015). It is possible to consider academic achievement as an outcome of education and acknowledge it as an indicator of to what extent a student, teacher, or educational institution has achieved its goals. Although academic achievement is usually assessed by exams, no consensus on how to assess it has been reached (Aduke, 2015). However, studies have pointed out that academic achievement has become increasingly functionalized with grades or grade point averages (GPA) (York, 2015). When the literature is reviewed, many studies have been found wherein GPA was used for academic achievement (Bahçetepe & Giorgetti, 2015; Choi, 2005; Qutishat & Sharour, 2019; Ward & Butler, 2019). From this perspective, the academic achievement of the students in this study was assessed by GPA.

Academic achievement is an important issue in school counselling (American School Counselor Association [ASCA], 2023), as it enables students to determine the course of their lives from primary education to higher education, and future expectations (Tokgöz, 2022). As licensed educators, school counsellors provide a school counselling program that assists the academic development of all students to achieve and exceed high academic standards (ASCA, 2023). In this context, they use interventions to improve the academic performance of students. To get the desired results, the interventions are required to be based on empirical evidence (Brown & Trusty, 2005). Therefore, identifying the variables influencing students' academic success experimentally may provide a substantial contribution to program development and intervention studies.

Academic success is one of the determinants of life success and well-being both in adolescence and adulthood (Hogan et al., 2010). The related research in the literature showed that academic achievement is positively correlated with positive indicators of psychological adjustment such as life satisfaction (Gilman & Huebner, 2006; Verkuyten & Thijs, 2002), psychological well-being (Yildiz Durak et al., 2022), subjective well-being (Bücker et al., 2018), and self-esteem (Li et al., 2018). On the other hand, low academic achievement is associated with behavioral dependencies (Sahin et al., 2016; Zhang et al., 2018), substance abuse, violent behavior (Herndon et al., 2015), conduct problems, and mental health problems (McLeod et al., 2012; Myat Zaw et al., 2022). Hence, it is crucial to identify the components that affect academic achievement for the prevention of academic failure and to lead the way for the development of various intervention approaches. Accordingly, this study aimed to demonstrate the correlations between metacognition, ASC, and academic achievement levels of adolescents who attended secondary and high schools.

Metacognition and Academic Achievement

Metacognition is a term that entered psychology in the 1970s and educational and developmental psychologists (Schwarz, 2015) that refers to thinking activities about thinking and cognitions about cognition (Flavell, 1979; Karakelle & Saraç, 2010). A concept employed to describe learning, metacognition covers the mechanisms by which students manage their studies (for instance, by selecting study intervals and what and how to study during this time) and track their progress. (Hennecke & Bürgler, 2022). Metacognition includes the processes of monitoring, controlling, and regulating cognition (Pintrich, 2002). More specifically, it is characterized by metacognitive experiences, emotions (e.g., familiarity, hardship), judgments (e.g., learning judgment), and task-specific online information (Efklides, 2006).

Metacognition literature has pointed out that metacognition consists of two dimensions: knowledge about cognition and regulation of cognition (Flavell, 1979; Kallio et al., 2018). Knowledge of cognition is related to information or ideas about how various elements or variables interact to influence the nature and results of cognitive procedures (Flavell, 1979). Cognitive knowledge is composed of three subcomponents: Conditional knowledge (understanding when and why to learn), declarative knowledge (understanding the elements of learning), and procedural knowledge (understanding how to apply learning techniques) (De Jong & Ferguson-Hessler, 2010; Schraw et al., 2006). Additionally, the regulation of cognition defines a set of actions that support students in controlling their learning process (Vrugt & Oort, 2008). These activities involve skills that facilitate individuals' learning, such as organizing information, understanding monitoring approaches, debugging techniques, and evaluation strategies (Schraw & Dennisson, 1994; Veenman et al., 2006). Consequently, it can be asserted that metacognition plays a critical role in individuals' learning and studying (Tuononen et al., 2023) and affects academic achievement. Hence, numerous studies have reported that metacognition is associated with high levels of academic performance (Ohtani & Hisasaka, 2018; Veas et al., 2019; Ward & Butler 2019). The meta-analysis study conducted by Ohtani and Hisasaka (2018) showed that metacognition was one of the important indicators of academic performance when the variable of intelligence was taken under control.

Metacognition and Academic Self-Control

Self-control is characterized as the ability to overcome temptation and unwanted impulses and willingly regulate emotions, thoughts, attention, and behaviors in order to achieve more worthwhile goals in the long term (Milyavskaya et al., 2019; Tangney et al., 2004; Vohs & Baumeister, 2004). Good levels of self-control are linked to beneficial outcomes in a variety of areas of life, such as academic achievement, positive interpersonal relationships, confident financial behaviors, physical health, and

psychological well-being (de Ridder et al., 2012; Duckworth & Seligman, 2005; Şimşir & Dilmaç, 2022; Tangney et al., 2004). Therefore, some psychologists consider self-control as the "greatest human strength" (Baumeister & Tierney, 2011). However, it is often difficult to display self-controlled behavior. This is because self-control may require forgoing chocolate while on a diet, ignoring a text message on the phone to get to the end of reading an important article, or hitting the gym instead of wasting time watching TV for hours on end (Duckworth et al., 2016). Similarly, almost all students are faced with a dilemma between academic goals that they care about in the long term and non-academic goals that they find more satisfying at the moment (Duckworth et al., 2019). They, therefore, need strong ASC skills to resolve this dilemma in line with their long-term goals.

Self-control people exhibit in the academic domain is conceptualized as ASC (Büyük et al., 2020). ASC includes perseverance, self-study, the ability to delay instant gratification, efficient time management, planning, and approaches to problem-solving that facilitate coping with academic challenges (Kennett & Keefer, 2006). The ASC includes two key components: academic self-compassion, which involves adopting a compassionate and polite attitude towards oneself when confronted with personal setbacks, and academic resourcefulness, which entails possessing the resources to cope with the challenges and barriers encountered in the pursuit of academic objectives (Büyük et al., 2020; Martin & Kennett, 2018). These processes related to ASC require the use of metacognitive skills. Indeed, Duckworth et al., (2014) highlighted that self-control is metacognitive in nature.

The *process model of self-control* proposed by Duckworth et al., (2014; 2016) suggests that school-age children must require the implementation of self-control, a skill that relies on mastering metacognitive, prospective strategies to resolve conflicts in the academic domain. According to the model, there are five sequential strategies for dealing with unwanted impulses (situation selection, situation modification, attentional deployment, cognitive change, and response modulation), and such strategies are based on metacognitive skills. During the process of ASC, individuals endeavor to metacognitively manage their own behaviors, emotions, and thoughts in order to resolve the conflict in accordance with their objectives.

Academic Self-Control and Academic Achievement

The factors influencing academic achievement have been among the prominent research topics for scientists from many disciplines from the past to the present (Dilmaç & Şimşir Gökalp, 2022). Over the past decades, academic achievement has been acknowledged to rely on cognitive elements such as academic skills and intelligence (Khine, 2016). However, recent studies have shown that noncognitive factors such as self-control and perseverance are important determinants of academic achievement (Duckworth & Seligman, 2005; 2006). Noting that females are more successful than males in almost all subjects at all levels of education, the study conducted by Duckworth and Seligman (2006) reported that this difference lies not in the higher intelligence of girls but in their higher self-control. Students with strong self-control handle self-control conflicts in accordance with their long-term objectives. For instance, they prefer to study math, a course that is more valuable in the long run but not as fun at that moment, rather than scrolling through Instagram, an activity that is enjoyable at that moment (Duckworth et al., 2019). Having self-control skills in the academic domain involves behaviors such as reading the instructions of the test before moving on to the questions, concentrating on the teacher instead of daydreaming, doing assignments rather than watching TV, insisting on the task despite boredom and failure, and postponing academic tasks less (Duckworth & Seligman, 2006; Kennett et al., 2013). Briefly, students with high self-control in the academic domain seek ways to solve their personal problems and use effective methods to succeed; they neither give up easily nor get anxious (Büyük et al., 2020).

Advancements in information and communication technologies have accelerated the need for students to adopt self-control skills. Although the academic tasks of students have been quite similar across generations (homework, exams, quiz, etc.), competitive digital distractions (social media, video games, etc.) have dramatically increased in recent years (Duckworth et al., 2019). The amount of time students spend in front of a screen has risen substantially, especially during the COVID-19 pandemic (Şimşir Gökalp et al., 2022). During and after the pandemic, noncognitive abilities including motivation and self-regulation that affect students' academic achievement have become more significant (e.g., Yildiz Durak et al., 2022). Therefore, there is a need for further studies on the processes that underlie ASC and the consequences it brings about.

The Present Study

As aforementioned, academic achievement, one of the factors affecting the future lives of adolescents, is a significant developmental task (Havinghurts, 1972). Therefore, the determination of the dynamics that improve academic achievement can significantly contribute both to the literature and to the intervention programs to be developed. For example, school counselors can integrate activities related to ASC and metacognition into group counseling programs to improve students' academic performance. Likewise, teachers can also include some activities to help students acquire these skills. This study aimed to examine the correlations between metacognition, ASC, and academic achievement among adolescents who attend secondary and high school and to test the mediating role of ASC in the correlation between metacognition and academic achievement. The following hypotheses would be tested for this purpose:

H1. Metacognition significantly and directly predicts academic achievement in adolescents.

H2. Metacognition directly predicts ASC in adolescents.

H3. ASC directly predicts academic achievement in adolescents.

H4. Metacognition predicts academic achievement through ASC in adolescents.

METHOD/MATERIALS

Design

The present investigation adopted a correlational research approach founded on the method of quantitative research. The goal of a correlational study is to investigate the links between two or more variables without manipulating them (Fraenkel et al., 2012). In this study, academic achievement is the dependent variable, metacognition is the independent variable, and ASC serves as the mediating variable.

Participants and Procedures

The data for this study were gathered from adolescents in a high school and a secondary school in two distinct big cities in Türkiye. The study comprised 596 students in total. 24 students were removed from the data set due to incomplete responses, and analyses were then performed on the remaining 572 participants in the data set. 60.1% of the participants were female (344), and 39.9% (228) were male. The ages of the participants ranged from 11 to 17 (M = 14, SD = 1.28).

Data for the study were gathered in the 2022-2023 academic year. Ethical permission was received from the ethics committee of the Faculty of Education at a public institution before collecting research data. Following that, approval was acquired from instructors and school administration where the data would be gathered. During class time, school counselors entered the classrooms to gather data face-to-face from the students. The students were informed about the principles of volunteering and the objective of the study prior to data collection. The students filled out the scales in around 15 to 20 minutes.

Instruments

Demographic Questionnaire: It was developed by researchers to gather details about the participants' gender, age, grade level, and GPA.

Academic Self-Control Scale (ASCS): The ASCS was created by Büyük et al. (2020) to assess secondary school students' ASC behaviors. ASCS comprises 12 items and two sub-dimensions (academic perseverance and academic attention). Each item in the scale is scored between 1 and 5 (1= Never, 5=Always). Higher scores on the measure indicate greater academic control. The following is an instance of a scale item: “Even if my desk-mate tries to make me chat, I pay my attention to the lesson”. The scale's overall Cronbach alpha coefficient was .81. The Cronbach alpha coefficient in the present investigation was determined to be .79. According to the confirmatory factor analysis (CFA) results, the goodness of fit indices of the scale is within the acceptable ranges ($\chi 2/sd = 2.94$, CFI = .97, TLI = .91, RMSEA = .06).

Metacognitive Awareness Inventory for Children (Jr. MAI-B Form): Jr. MAI-B was created by Sperling et al. (2002) to assess students' metacognitive abilities in grades three through nine. The Turkish translation study of the scale was conducted by Karakelle and Saraç (2007). The A form of the Jr. MAI is used for students in the 3rd to the 5th-grade range, and the B form is used for 6th to 9th-grade students. The scale has a one-dimensional structure and each item in the scale is scored between 1 and 5 (1= not suitable for me at all, 5= suitable for me all). An example item in the scale is as follows: “I know whether I understand something or not”. The scale's overall Cronbach alpha coefficient was .80. The Cronbach alpha coefficient in the present investigation was determined to be .87. According to the CFA results, the goodness of fit indices of the scale is within the acceptable ranges ($\chi 2/sd = 2.41$, CFI = .92, TLI = .96, RMSEA = .05).

Data Analyses

The data analysis for this study was completed in two steps. In the first step, descriptive statistics such as mean, standard deviation (SD), normality distribution (skewness and kurtosis values), and Pearson correlation coefficients were calculated for the preliminary analyses. The correlation coefficient was examined to determine whether there was a multicollinearity problem. According to Tabachnick and Fidell (2015), a correlation coefficient above .90 indicates a multicollinearity problem. Furthermore, the scales' Cronbach alpha coefficients were examined at this step. In the second step, a mediation analysis was performed to identify whether ASC had a mediating role in the association between metacognition and academic achievement 5000 bootstrap samples with a 95% confidence interval (CI) proposed by Hayes (2018) were used to assess the statistical value of the mediating effects of the model examined in the study. This analysis suggests that the interval between these two values should not contain zero and that the lower and upper limits of the CI values should take values in the same direction (Hayes, 2018). The data analysis was performed using the software jamovi V 2.2 (R Core Team, 2021; The Jamovi Project, 2021).

FINDINGS

Preliminary Analyses Results

Table 1 displays the descriptive statistics and Pearson's correlation coefficients for the variables investigated in the study.

Table 1. Descriptive Statistics and Correlations Among Study Variables

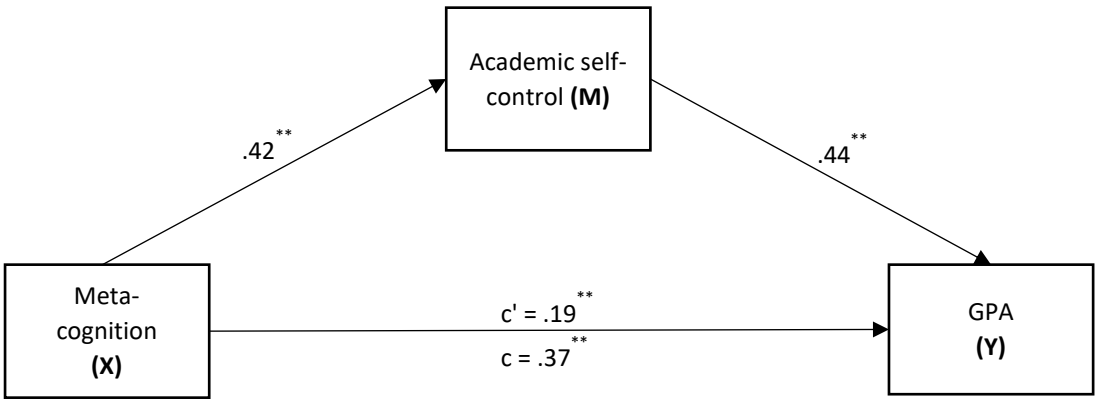
Variable	1	2	3	M	SD	Skew.	Kurt.
1. Meta-cognition	-			66.35	11.13	-.30	.07
2. ASC	.51**	-		40.56	9.24	.35	-.51
3. GPA	.36**	.44**		71.67	11.57	.05	-.36

**p < .001, ASC: Academic Self-Control, GPA: Grade Points Average

The preliminary analysis results demonstrated that skewness values ranged between -.30 and .35. The kurtosis values ranged between -.51 and -.36. According to George and Mallery (2022) because all of the values fall within the range of -2 to +2, this suggests that the distribution characteristics are suitable for further analysis. The results of Pearson correlation analysis showed that meta-cognition was positively correlated with ASC (r = .51, p < .001), and GPA (r = .36, p < .001). ASC was also positively associated with GPA (r = .44, p < .001).

Mediation Analysis Results

Mediating model results established using the research variables are displayed in Figure 1 and Table 2.



Note: **p < .001, GPA: Grade Points Average

Figure 1. Diagram of Mediation Model

The mediating role of ASC in the relationship between meta-cognition and GPA was examined among adolescents. This model showed that meta-cognition predicted ASCl (B = .42, p < .001), and ASC predicted GPA (B = .44, p < .001). Furthermore, the model indicated that meta-cognition had a positive direct effect (B = .19, p < .001) and indirect effect (B = .18, p < .001) on GPA. The total effect of meta-cognition on GPA is also statistically significant (B = .37, p < .001). Lately, it has been observed that this model revealed that the predictor variables accounted for 22% of the variation in GPA scores.

Table 2. Model Pathways and 95% CIs for the Paths of the Mediation Model

			95% C.I. (a)		
Effect	**Estimate**	**SE**	**Lower**	**Upper**	**p**
Meta-cognition ⇒ ASC	.42	.02	.36	.48	< .001
ASC ⇒ GPA	.44	.06	.32	.55	< .001
Meta-cognition ⇒ GPA	.19	.04	.01	.27	< .001
Indirect Effect	.18	.03	.13	.24	< .001
Direct Effect	.19	.04	.11	.27	< .001
Total Effect	.37	.04	.29	.46	< .001

Note: ASC: Academic Self-Control, GPA: Grade Points Average

The study examined whether the indirect effect in the tested model was statistically significant by conducting the analysis on 5000 bootstrap samples. Table 2 presents the outcomes of the estimates assessed within the 95% confidence interval. As a result, the direct and indirect effects of metacognition on academic achievement are significant, and ASC has a partial mediator role in this effect.

DISCUSSION

One of the key questions in the field of educational psychology is "Why do some students give up when they come across academic challenges, while others achieve higher grades by utilizing various strategies and persevering" (Dilmaç & Şimşir Gökalp, 2022; Mega et al., 2014). Although the responses of researchers to this question vary, the umbrella term that refers to factors that

affect academic performance other than intelligence and ability is noncognitive factors (e.g., Farrington et al., 2012; Han et al., 2022; Lee & Stankov, 2018). The term noncognitive commonly defines a broad variety of personal qualities, skills, and characteristics that represent a person's mental, emotional, behavioral, motivational, and other psychosocial propensities. (Lee & Stanko, 2018). Noncognitive factors affecting achievement include many concepts ranging from family-related factors to personality traits, self-regulation skills, and mental health (Farrington et al., 2012; Thom & Finkelstein, 2016). In the present investigation, the role of metacognition and ASC among these factors was examined. A mediation model that addresses the correlations between metacognition, ASC, and academic achievement was established hereunder, and the mediating role of ASC in the correlation between metacognition and academic achievement was tested.

The findings of the study showed that metacognition significantly predicted ASC in adolescents (H1). A study conducted by Yılmaz-Tüzün and Topçu (2007) with primary and secondary school students reported that metacognition skills and academic achievement were positively correlated. A study conducted by Young and Fry (2008) with college students found a positive association between metacognition and academic achievement. From this perspective, the finding of this research is compatible with the literature (e.g., Bağçeçi et al., 2011; Case et al., 1992; Emrahoğlu & Öztürk, 2010; Gul & Shehzad, 2012; Yenice et al., 2017). Metacognition implies a high degree of thinking that includes having control over cognitive processes related to learning and incorporates activities such as organizing the task to be learned, monitoring the steps, and assessing progress (Livingston, 2003). Students who have effective metacognitive skills monitor their learning, refresh their knowledge, and make plans for new learning (Everson & Tobias, 1998). From this perspective, metacognition as a skill that improves students' academic achievement is not a surprising consequence.

Based on the findings of the present research, metacognition significantly affected ASC in adolescents (H2). A longitudinal study conducted by Wang et al., (2021) with adolescents between the ages of 11 and 15 reported that there was a significant link between metacognition and self-control. An experimental study by Nursalam and Rozana (2022) on 6th-grade students reported that metacognitive skills improved ASC. Briefly, studies in the literature (Bahadorikhosroshahi & Habibi-Kaleybar, 2017; Chernokova, 2014; Hennecke & Bürgler, 2023) have supported the finding that metacognition significantly ASC. Self-control describes an individual's ability to manage their own behaviors and adapt them to varying situations, and direct occasions (Ekşi et al., 2019). Bandura (1989) also describes self-control as the person's capacity to control his or her own thought processes, motivations, and actions. Metacognition also represents the monitoring and controlling of thought (Martinez, 2006). Metacognition plays a crucial role in people's self-control (Flavell, 1979).

The analysis results showed that ASC directly predicted academic achievement in adolescents (H3). The related studies in the literature have supported this finding (Bertrams & Dickhäuser, 2009; Duckworth & Seligman, 2006; Duckworth et al., 2019; Li et al., 2022; Normandeau & Guay, 1998). The study performed by Dzinovic et al. (2019) on 8th-grade students reported that students with high levels of self-control achieved more academic achievement. The study conducted by Duckworth and Seligman (2006) on 8th-grade students indicated that higher academic achievement of female students compared to male students was associated with their higher level of self-control. A study carried out by Stadler et al. (2016) with college students reported that self-control significantly accounted for academic achievement. Self-control is a dynamic motivational system that allows an individual to set goals, develop and put into practice strategies to achieve these goals, and revise goals and strategies by evaluating progress (Vohs & Baumeister, 2016). From this point of view, self-control directly affects students' academic achievement (Maranges & Baumeister, 2016).

Finally, metacognition significantly predicts academic achievement in adolescents through ASC (H4). Although there is no study that examines the mediating effect of metacognition, ACS and academic achievement variables, the relationships between the variables can be explained from the statements in the literature and similar studies. Schraw and Dennison (1994) point out that metacognition involves the ability to control the individual's learning processes and emphasize that cognition and regulation can work together to support students' self-regulation processes. Based on this, it can be stated that students who have metacognitive characteristics, that is, the ability to understand and control their learning processes, will have higher levels of ASC. In the literature, metacognitive awareness is associated with self-regulatory behaviors that contribute to academic success (Zimmerman, 2002). Based on all these explanations, developing metacognitive awareness in educational settings is very important to increase students' self-control and ultimately support their academic success. Self-control is a qualification that depends on mastering metacognitive strategies (Duckworth et al., 2014). Therefore, a framework explaining the role of metacognition on self-control is necessary for an accurate understanding of self-control. There is, however, no comprehensive framework or model that illustrates the structural and functional components of metacognition before, during, and after the experience of self-control conflict exists yet (Hennecke & Bürgler, 2022). The *process model of self-control* proposed by Duckworth et al., (2016) introduced self-control strategies and drew attention that these strategies are based on metacognitive skills. The model suggested the association of self-control with academic accomplishment, as well as a number of applications that students can develop to resolve conflicts related to academic tasks. Nevertheless, the model did not address individual differences, conflict perception, or monitoring mechanisms during self-control conflict experiences (Hennecke & Bürgler, 2022). Hence, the results of the present study not only support the process model of self-control but also contribute to the model.

CONCLUSION AND RECOMMENDATIONS

The findings of the present study are important both for broadening the literature and for providing empirical evidence for the process model of self-control. However, some limitations should be taken into consideration when evaluating the results of the

present study. Secondary and high school students who attended secondary and high school in two provinces of Türkiye participated in the study. Accordingly, the results of the study cannot be generalized to all adolescents. Self-report scales were utilized to collect data in the study. There is a possibility that the participants may have acted haphazardly while responding to these scales, not paying attention, or responding in a way that misrepresents themselves to gain social appreciation. In this regard, it may be useful to employ parent-report or teacher-report scales as well as self-report scales in future studies. Also, since this was a cross-sectional study, it was not possible to gather in-depth information about the participants or to follow the participants during the process. Qualitative and longitudinal studies may be necessary in the future to eliminate such limitations. Longitudinal studies are required to draw more in-depth theoretical inferences and to better understand the links between metacognition, ASC, and academic achievement.

In conclusion, the results of the present study indicated that ASC and metacognition positively affected academic achievement and ASC played a mediating role in the correlation between metacognition and academic achievement. These results can guide school counsellors in the process of creating a comprehensive program and planning strategic interventions to improve students' academic achievement. For example, school counsellors may develop ASC psychoeducational programs for middle school and high school students and incorporate activities to improve metacognitive skills into these programs (e.g., Duckworth et al., 2014; 2016). They may also consider providing individual coaching or group counselling to adolescent students in order to help them improve ASC and metacognitive skills. Teachers can design classroom activities that require students to set goals for their future, explore internal and external sources of motivation, monitor their progress and reflect on their learning. They can also create group activities where students can share and discuss their learning strategies. Parents can support their children to reflect on and become aware of the learning strategies that work for them. They can also support the use of self-control strategies in everyday life, such as time management for studying, exploring internal and external sources of motivation, and setting limits on distractions (such as screen time).

Declaration of Conflicting Interests

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Statements of Publication Ethics

We hereby declare that the study has no unethical issues and that research and publication ethics have been observed carefully.

Researchers' Contribution Rate

Researchers' contribution rate First Author: Desing, Supervision, Analysis and Interpretation, Writing, Critical Review; Second Author: Data Collection, Writing, and Editing; Third Author: Data Collection, Writing

Ethics Committee Approval Information

The study was approved by the Faculty of Education Ethics Committee of Selçuk University (Date/Num: 11.07.2023-56).

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