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The Effect of the Growth Mindset Approach on Mathematics Achievement in Socioeconomically Disadvantaged Children*

Gelişim Zihniyeti Yaklaşımının Sosyoekonomik Olarak Dezavantajlı Çocukların Matematik Başarısı Üzerindeki Etkisi

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ABSTRACT: This study investigates the impact of growth mindset strategies on self-efficacy, self-regulation, metacognitive skills, academic achievement, and mindset beliefs of socio-economically disadvantaged eighth-grade students in Turkey. An embedded mixed-method design was employed with 57 students (experimental group: 28; control group: 29) over an eight-week intervention. Quantitative data were collected *via the Mindset Scale, Self-Efficacy Scale, Self-Regulation Scale, Metacognitive Skills Scale*, and *the Academic Achievement Test*, administered both before and after the intervention. Qualitative data were gathered through semi-structured interviews and classroom observations conducted before, during, and after the application. Qualitative data were gathered through semi-structured interviews and classroom observations conducted before, during, and after the intervention and were analyzed using thematic content analysis. Quantitative data were analyzed using ANCOVA, Mann–Whitney U test, and t test. Findings revealed significant improvements in favor of the experimental group in all measured variables. The qualitative results supported the quantitative data, indicating that students exposed to growth mindset strategies developed attitudes such as persistence in the face of difficulty, increased effort, determination, and goal orientation toward mastery. Overall, the study demonstrates that structured growth mindset interventions can effectively enhance both cognitive and motivational outcomes among disadvantaged learners.

Keywords: Growth-mindset, metacognitive skills, mindset beliefs, self-efficacy, self-regulation.

ÖZ: Bu araştırma, Türkiye'de sosyo-ekonomik açıdan dezavantajlı sekizinci sınıf öğrencilerinin öz yeterlik, öz düzenleme, biliş üstü beceriler, akademik başarı ve zihniyet inançları üzerindeki gelişim zihniyeti stratejilerinin etkisini incelemektedir. Sekiz hafta süren uygulama sürecinde 57 öğrencinin (deney grubu: 28; kontrol grubu: 29) yer aldığı iç içe geçmiş karma yöntem deseni kullanılmıştır. Nicel veriler, uygulama öncesi ve sonrasında uygulanan *Zihniyet Ölçeği, Öz Yeterlik Ölçeği, Öz Düzenleme Ölçeği, Biliş Üstü Beceriler Ölçeği* ve *Akademik Başarı Testi* aracılığıyla toplanmıştır. Nitel veriler ise uygulama öncesi, süreci ve sonrasında gerçekleştirilen yarı yapılandırılmış görüşmeler ve sınıf içi gözlemler yoluyla elde edilmiş ve tematik içerik analizi ile çözümlenmiştir. Nicel verilerin analizinde ANCOVA, Mann–Whitney U testi ve t testi kullanılmıştır. Bulgular, ölçülen tüm değişkenler açısından deney grubu lehine anlamlı farklılıklar olduğunu ortaya koymuştur. Nitel bulgular da nicel sonuçları destekleyerek, gelişim zihniyeti stratejilerine maruz kalan öğrencilerin zorluklar karşısında sebat etme, daha fazla çaba gösterme, kararlılık geliştirme ve ustalık yönelimli hedefler belirleme gibi tutumlar geliştirdiklerini göstermiştir. Genel olarak çalışma, yapılandırılmış gelişim zihniyeti müdahalelerinin dezavantajlı öğrencilerde hem bilişsel hem de motivasyonel çıktıları etkili biçimde geliştirebileceğini ortaya koymaktadır.

Anahtar kelimeler: Gelişim zihniyeti, öz-yeterlik, öz-düzenleme, üstbilişsel beceriler, zihniyet inancı.

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Intelligence has long been discussed as either a fixed trait or a malleable capacity shaped by effort and learning. Contemporary research increasingly supports the view that beliefs about the nature of intelligence play a critical role in students' motivation, learning behaviors, and academic achievement (Dweck, 2006; Yeager & Dweck, 2012). According to Growth Mindset Theory, believing that intelligence can be developed through effort fosters persistence, adaptive learning strategies, and resilience in the face of academic challenges.

Socioeconomic disadvantage is widely recognized as a significant factor influencing academic achievement; however, it does not affect all students uniformly. While limited resources and structural constraints pose challenges, individual beliefs and motivational processes may buffer the negative effects of socioeconomic disadvantage (OECD, 2019a; Zhao et al., 2021). Research indicates that growth mindset–based interventions are particularly effective for students facing academic risk, including those from socioeconomically disadvantaged backgrounds and those experiencing key educational transitions (Burnette et al., 2013; Claro et al., 2016; Sisk et al., 2018).

In Turkey, socioeconomic disadvantage has been shown to exert a strong influence on student achievement, especially in high-stakes assessments (OECD, 2020). The transition from middle school to high school, determined largely by performance on the High School Entrance Examination, represents a critical academic period for eighth-grade students. National examination statistics consistently reveal that mathematics is the subject with the lowest average performance, making it a key determinant of overall academic success (MoNE, 2022). Moreover, mathematics achievement is often attributed to innate ability rather than effort, which may reinforce fixed mindset beliefs and limit students' academic engagement (Becker, 1981; Boaler, 2002).

Previous studies have demonstrated that growth mindset interventions can positively influence academic achievement as well as related motivational and cognitive variables such as self-efficacy, self-regulation, metacognitive skills, and mindset beliefs (Burnette et al., 2013; Hong et al., 1999; Wang et al., 2021). These variables are closely interconnected and collectively contribute to students' learning processes and academic outcomes. However, research conducted in the Turkish context remains limited, particularly studies focusing on socioeconomically disadvantaged middle school students during the transition to high school.

The present study addresses this gap by examining the effects of a growth mindset–based intervention on mathematics achievement and selected motivational and cognitive variables among socioeconomically disadvantaged eighth-grade students in Turkey. By integrating both quantitative and qualitative data, this study aims to provide context-sensitive evidence on the effectiveness of growth mindset interventions in a high-stakes examination environment and to contribute to the limited national literature in this field.

This study aims to examine the effect of a growth mindset–based intervention on selected cognitive, motivational, and academic outcomes of eighth-grade students. Accordingly, the following research questions were addressed:

1. Is there a significant difference between the experimental and control groups in terms of self-efficacy post-test scores when pre-test scores are controlled?

2. Is there a significant difference between the experimental and control groups in terms of self-regulation post-test scores when pre-test scores are controlled?
3. Is there a significant difference between the experimental and control groups in terms of metacognitive skills post-test scores when pre-test scores are controlled?
4. Is there a significant difference between the experimental and control groups in terms of mathematics academic achievement post-test scores when pre-test scores are controlled?
5. Is there a significant difference between the experimental and control groups in terms of mindset beliefs post-test scores when pre-test scores are controlled?
6. What are the experimental group students' views regarding the use of growth mindset strategies during the intervention process?
7. How did the growth mindset–based intervention reflect on student–teacher interaction and the classroom environment in mathematics lessons?

Literature Review

The socio-economic characteristics of students stand out as an important factor among the variables determining academic success. In other words, socio-economic status is seen as an important variable determining success (Ahmar & Anwar, 2013; Aslanargun et al., 2016; Barry, 2006; Caro et al., 2009; Chiu & Chow, 2015; Pokropek et al., 2015; Selvitopu & Kaya, 2023; Sirin, 2005; Suna et al., 2020; Tomul & Savaşçı, 2012; Walton & Yeager, 2020); however, low socio-economic status may not always be a negative factor (OECD, 2019b). Some studies indicate that students from medium socio-economic families show higher academic success compared to students with high socio-economic levels (De Fraja et al., 2010; Madland & Bunker, 2011; Süer, 2014). In the OECD report evaluating the 2018 PISA results, it is stated that low socio-economic status does not always mean low performance, and many socio-economically disadvantaged students can demonstrate high performance by striving to overcome difficulties (OECD, 2019a). The belief that intelligence and talent are not fixed but can be developed creates an opportunity for socio-economically disadvantaged students to create change in their lives through hard work and effort (Browman et al., 2017). For socio-economically disadvantaged students, having a growth mindset provides hope and optimism regarding their future academic success as well as motivation to improve their current social status (Zhao et al., 2021).

In particular, the role of academic success in determining the future through central exams on a Turkish scale is an important starting point for socio-economically disadvantaged students in terms of the impact of education on determining their position in society (İnce, 2018). Using central exam results as a criterion during the transition to secondary education makes academic success a determining factor in school selection for 8th grade students (Çakıoğlu & Ergen, 2022; Ulusoy, 2020). According to the Performance of Students Placed by High School Transition System Central Examination report published by the Ministry of National Education (2022), 19% of the students who took the exam can be placed in secondary education institutions that accept students by exam, while the remaining students are placed in the nearest high schools or open education high schools according to the local placement system. In the

secondary education transition system, the classification of schools in terms of quality and the fact that a small number of students can be placed in these schools leads to competition among students (Demir & Yılmaz, 2019); success in certain disciplines is also a determinant of overall success in this exam (Delioğlu, 2017). According to 2022 LGS statistics, the course with the lowest average rate of students answering questions correctly is mathematics (MoNE, 2022). These results are similar in 2019, 2020 and 2021 (MoNE, 2021). These findings regarding mathematics exam success also shed light on the critical importance of mathematics in determining overall exam success. At the same time, mathematics success in LGS stands out as an important indicator in distinguishing the socio-economic characteristics of students in Turkey (Yüksel & Ertürk, 2023).

It is known that mathematics is considered a challenging course for most students (Hart, 1980) and failure in mathematics is perceived as an unchanging situation (Becker, 1981; Boaler, 2002). In addition, mathematics success is often attributed to innate abilities rather than hard work and effort (Ahn et al., 2016; Demir, 2019; Kılıç, 2015; Süer, 2014). These attitudes of students towards mathematics and the way they define mathematics can also be a determinant of academic success (Delioğlu, 2017). Students' beliefs about what they can achieve in mathematics can change their negative mathematics perceptions (Boyer & Mailloux, 2015); Their anxiety may negatively affect their attitudes towards the course (Karadag & Karadeniz, 2014). In this context, it is thought that supporting the belief in the developable nature of intelligence put forward by the Growth Mindset Theory can change the negative perception of mathematics and create a multiplier effect that positively affects academic success (Blackwell et al., 2007; Hong et al., 1999). Because current research reveals that the use of growth mindset strategies, which can be used to support the belief in the malleable nature of intelligence, contributes to encouraging socio-economically disadvantaged and low-performing students to strive and struggle with academic difficulties (Burnette et al., 2013; Claro et al., 2016; Paunesku et al., 2015; Sarrasin et al., 2018; Yeager et al., 2014).

Blackwell et al. (2007) argue that middle school represents a major transition "emphasizes competition, social comparison, and self-evaluation of ability at a time of increased self-focus" (p. 246). For this reason, it is thought that the biggest impact of using growth mindset strategies is on those who are in the transition period to high school and especially on socio-economically disadvantaged students in relation to the mathematics course with low academic performance.

Beside academic success, growth mindset is also in a close relationship with self-efficacy (Burnette et al., 2013; Mcwilliams, 2015; Samuel & Warner, 2021); self-regulation (Job et al., 2015; Karlen et al., 2021; Mrazek et al., 2018; Wang et al., 2021), metacognitive skills (Bai et al., 2020; Hong et al., 1999; Kachnowski, 2019) and mindset beliefs (Burnette et al. 2013; Sarrasin et al., 2018; Yeager et al., 2014). These variables highlight the multifaceted factors that influence students' success. It is thought that the strong interaction between these concepts can play a complementary role in the processes of individuals' learning, development and achievement. In this context, examining the effects of growth mindset strategies on a mathematics course basis and in a sample size of socio-economically disadvantaged students constitutes the starting point of the current research.

Method

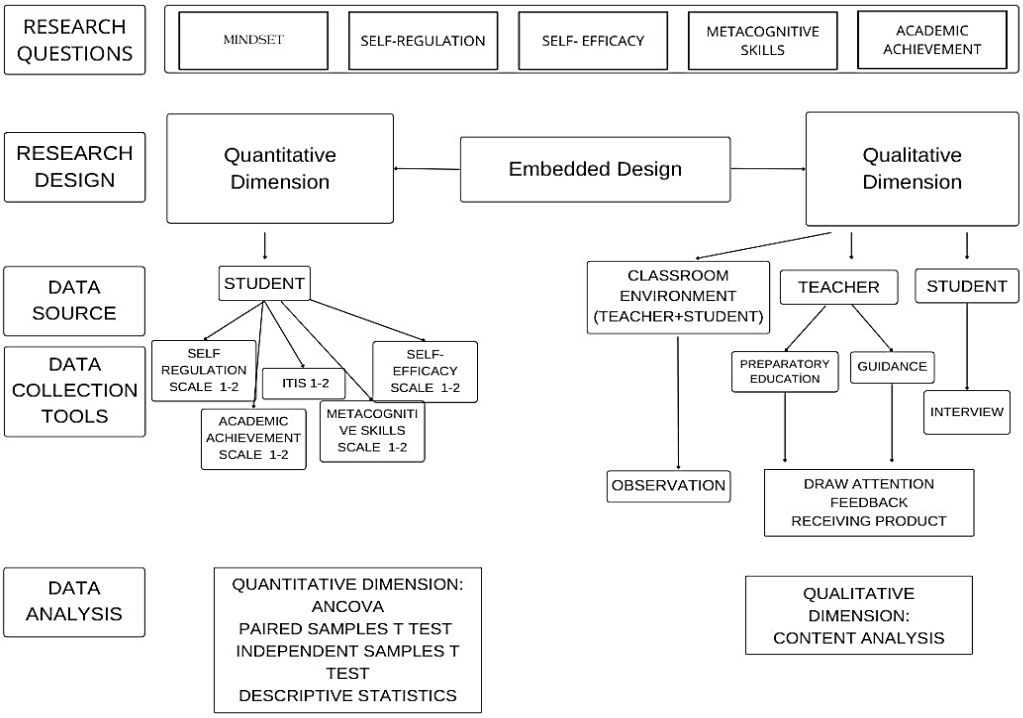
Research Design

This study was conducted using an embedded mixed methods design, as described by Creswell and Plano Clark (2007). In this design, quantitative data constituted the primary dataset, while qualitative data were embedded as a secondary dataset to support and enrich the interpretation of quantitative findings. The study followed a QUAN → qual sequence, in which qualitative data were collected concurrently with and subsequent to the quantitative phase to provide contextual insights into the intervention process.

A flowchart summarizing the research design and integration stages is presented in Figure 1.

Figure 1

Research Model



This study was designed as a quasi-experimental study with a pre-test–post-test control group design.

Participants and Study Group

The study group consisted of 57 eighth-grade students (experimental group: 28; control group: 29) enrolled in a public middle school located in a socio-economically disadvantaged area of a province in the Marmara Region of Turkey during the first term of the 2023–2024 academic year. The experimental and control groups were determined based on existing classes, as random assignment was not feasible due to institutional constraints. The selected school was identified as socio-economically disadvantaged based on objective indicators, including its below-average performance

in national high school entrance examinations reported by the Ministry of National Education and its location in a low socio-economic status area according to address-based enrollment data. Descriptive information regarding the study group is presented in Table 1.

Table 1

Descriptive Data for the Study Group

Group	**Gender (n)**	**Average Age of participants**	**Total**	**Mathematics GPA (Previous semester)**
Experimental	Girl	13.5	28	55.65
	Boy	13.9		
Control	Girl	13.4	29	56.25
	Boy	13.7		

In the current study, the sample was selected in line with the research objectives. The primary criteria for sample selection were the academic achievement and socio-economic characteristics of the study group. Accordingly, a middle school in Turkey with below-average performance in the High School Entrance Examination was selected.

Mathematics achievement was determined as the dependent variable of the study. The selected school was identified based on the Ministry of National Education's (MoNE, 2022) report indicating that students' average number of correct answers in mathematics was below the national average.

In addition, socio-economic conditions were assessed based on the researcher's observations during a one-year assignment at the school. These observations indicated that the school is located in a low socio-economic status area and serves students residing in the surrounding neighborhood through an address-based registration system. The study group consisted of 57 students aged between 13 and 14, enrolled in the 8th grade. The selection of this grade level was based on students being in a transition period to high school.

While the growth mindset intervention conducted within the current research scope is expected to impact students' academic achievement, as well as self-efficacy, self-regulation, metacognitive skills it is also anticipated to influence mindset beliefs. The potential effects of education involving growth mindset strategy use on the perceptions of success among socio-economically disadvantaged students, presumed to accept failure as an immutable group norm, are considered to offer a culturally valuable service. Therefore, including students demonstrating low academic achievement and socio-economic disadvantage in the research scope is significant both for observing the impact of the intervention and for the social benefit it provides.

Within the scope of the research, qualitative data was collected through observation and semi-structured student interviews before, during and after the intervention. Semi-structured one-on-one interviews were held with 6 students in the experimental group before the application, with 4 students during the application, and

with 5 students after the application. Information about the students who participated in the interviews is presented in Table 2.

Table 2

Information on Semi-structured Interview Participants

Interview Time	Code	Gender	Source of Family Income	Total	Mathematics GPA (Previous semester)
Before-intervention	S1	Girl	Domestic work	6	64.25
	S2	Boy	Day labourer		67.50
	S3	Boy	Day labourer		84.50
	S4	Girl	Day labourer		89.25
	S5	Girl	Domestic work		45.00
	S6	Boy	Government job		47.25
During-intervention (4. week)	S7	Boy	Day labourer	4	52.00
	S8	Girl	Day labourer		53.50
	S9	Girl	Day labourer		86.25
	S10	Boy	Domestic work		45.00
After-intervention	S11	Girl	Domestic work	5	47.50
	S12	Girl	Day labourer		42.25
	S13	Girl	Day labourer		68.75
	S14	BoyBoy	Day labourer		75.25
	S15		Government job		84.25

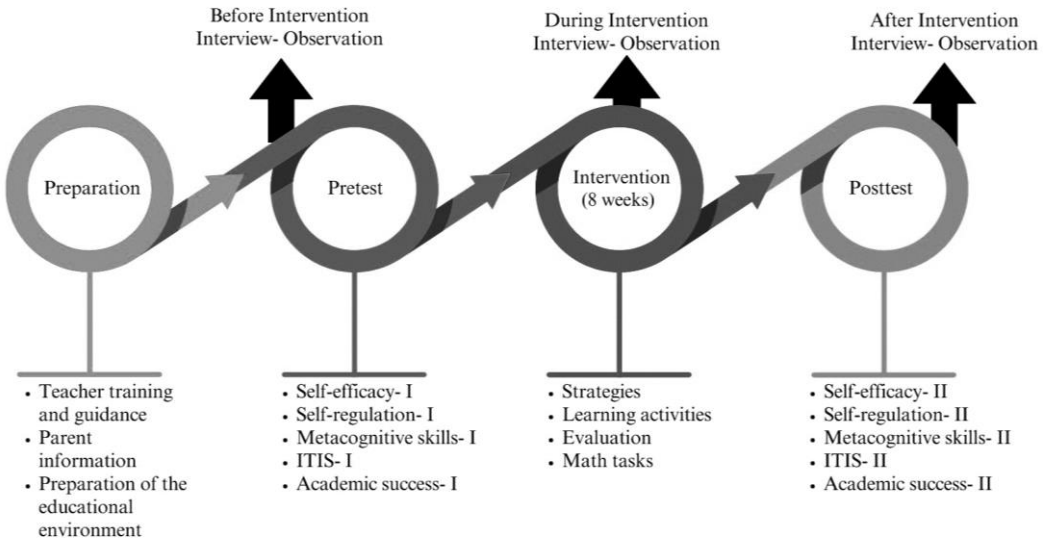
In determining the students with whom semi-structured interviews were conducted, care was taken to ensure that their mathematics grade point averages were equally distributed as low, medium and high according to their grade level. In this way, it is envisaged to ensure data diversity. Participants come from families in low socioeconomic income groups. Considering the income status, most of the parents are day labourer or domestic worker, earning low income in the Turkish conjuncture. Voice recordings were made during the interviews, each of which lasted approximately 20-35 minutes. The audio recordings were deciphered and transcribed.

Observations were conducted in the mathematics lessons of the experimental group for two class hours per week, totaling 20 class hours. The observation process spanned 10 weeks and was carried out before, during, and after the implementation of the intervention. Throughout the observations, attention was given to whether the teacher adhered to the growth mindset feedback guide, his communication with students, the students' behaviors during mathematics lessons, and the overall classroom environment. The observations took place in the experimental group's mathematics classes. The mathematics teacher is a 42-year-old male with 20 years of teaching experience.

At the same time, pretests and posttests were applied to experimental and control groups before and after the intervention. The flow chart of the implementation process is presented in Figure 2.

Figure 2

Implementation Process



Data Collection Instruments

Data collection instruments included the Self-Efficacy Scale, Self-Regulation Scale, Metacognitive Skills Scale, Implicit Theory of Intelligence Scale (ITIS), Academic Achievement Test, semi-structured interview forms, and an observation form. Quantitative instruments were administered as pre-tests and post-tests, while qualitative data were collected before, during, and after the intervention.

The Self-Efficacy, Self-Regulation, and Metacognitive Skills Scales were adapted into Turkish by Üredi (2005) and demonstrated acceptable internal consistency in the present study (Cronbach's α values > .80). The Implicit Theory of Intelligence Scale (Dweck, 1999) was adapted into Turkish by the researcher following standard translation and validation procedures, yielding high reliability (α = .89).

The Academic Achievement Test, developed by the researcher in line with the 8th-grade mathematics curriculum, consisted of 20 multiple-choice items. Content validity was ensured through expert review, and reliability was established using the KR-20 method (KR-20 = .77).

Qualitative data were collected through semi-structured interview forms administered at three stages (pre-, during-, and post-intervention) and a structured observation form. The trustworthiness of qualitative data was ensured through expert review, methodological transparency, and data triangulation.

Intervention Process

Growth mindset intervention includes learning objectives, strategies used, materials, activities, evaluation and task titles within the scope of 8 different modules. The module titles and learning objectives addressed during the intervention process are presented in Table 3.

Table 3

Growth- Mindset Intervention Modules and Learning Objectives

Modules	Learning Objectives
Module 1: What is Mindset?	• Understanding the difference between a fixed mindset and a growth mindset • Determining whether one has a fixed or growth mindset
Module 2: Brain Plasticity	• Establishing a relationship between the brain and learning • Understanding brain plasticity and how learning occurs
Module 3: Discussing the Brain and Learning Processes	• Evaluating a neuroscientific study • Discussing the brain's learning process
Module 4: Classroom Norms	• Creating classroom norms related to learning processes • Discussing the necessity of classroom norms
Module 5: Case Study	• Understanding that intelligence and abilities can be developed • Providing suggestions on the development of intelligence and abilities
Module 6: Goal Setting and Dealing with Mistakes	• Grasping goal-setting strategies • Setting goals related to mathematics • Understanding methods to cope with mistakes
Module 7: Facing Challenges	• Grasping methods to cope with challenges • Creating recommendations for overcoming challenges
Module 8: Reflection and Evaluation	• Conducting self-evaluation • Conducting group assessments

During the growth mindset training process, a process evaluation was made at the end of each module through alternative evaluation methods. At the same time, peer evaluation and self-evaluation and final evaluation were carried out in the last module. The evaluation dimension was beneficial in determining the effectiveness of the application at the end of each module and in increasing the permanence of learning.

In order to observe the effect of growth mindset training on mathematics course success and to establish a relationship between the two variables of the research, students were given tasks related to the educational content and mathematics course at the end of each module. These tasks are intended to encourage active participation in mathematics lessons, regular study, effort, development of study strategies, and self-confidence. The tasks were determined by the researcher in a way that would connect the topic discussed about growth mindset each week, and care was taken to ensure that the fulfillment of the tasks was observable. Whether or not the mathematical tasks were carried out by the students was monitored by the researcher and noted in a chart, and at the same time, while monitoring the student performance in lesson observations, it was tried to determine to what extent these tasks were carried out in the classroom.

During the preparation process before the application, an informative presentation about Mindset Theory was made to the mathematics course teacher of the experimental and control group. Within the scope of this presentation, information is given about the basic starting point of the theory, growth mindset and fixed mindset, and research findings on the neuroplasticity of the brain are explained.

Role of the Researcher

During the intervention process, the mathematics teacher implemented the instructional activities within regular classroom instruction. Prior to the intervention, the teacher received structured guidance regarding growth mindset principles and feedback practices. The researcher was not the primary instructor but acted as an observer and facilitator, providing preparatory training and monitoring the fidelity of implementation. Classroom observations were conducted systematically to document the process. To minimize potential researcher bias, quantitative data collection instruments were standardized, and qualitative data were analyzed using established thematic analysis procedures. Nevertheless, the presence of the researcher and the structured nature of the intervention may have influenced participants' engagement levels.

Ethical Procedures

The researcher held an information meeting for parents about the intervention process in which students would participate. During the meeting, an informative presentation about Mindset Theory was made for parents. For this training, it was aimed to obtain informed consent from the parents regarding the application and to provide parental support for the effective implementation of the application process.

In the current research, we acted in line with scientific ethical principles in the interpersonal context dimension. During the preparation process of the research, the relevant application permission (E-86980341-605,01-71849238) was obtained from Yıldız Technical University. Before starting the implementation process of the research, informed consent was obtained from the participating students and their families; necessary information was provided to the school administration, teachers, students and families.

Results

Quantitative data were analyzed using SPSS. Analysis of covariance (ANCOVA) was conducted to examine the effect of the growth mindset–based intervention on students' self-efficacy, metacognitive skills, and mathematics academic achievement, with pre-test scores entered as covariates. Prior to ANCOVA, assumptions of normality, linearity, homogeneity of regression slopes, and homogeneity of variances were examined. Normality was assessed using skewness–kurtosis values and the Shapiro–Wilk test, while Levene's test was used to evaluate the homogeneity of variances. The homogeneity of regression slopes assumption was tested by examining the interaction between the covariate and group variable.

Since the Implicit Theory of Intelligence Scale scores did not meet the normality assumption, differences between the experimental and control groups were analyzed using the non-parametric Mann–Whitney U test. Effect sizes were calculated and

reported for all analyses. Partial eta squared (η^2p) values were reported for ANCOVA results, and effect size estimates (r) were calculated for the Mann–Whitney U test.

The data related to the results of the covariance analysis are presented in Table 4.

Table 4

Covariance Analysis Results

	Tip III Sum of Squares			
Source		**df**	**F**	**Sig.**
Corrected Model	32.793	2	30.696	.000
Intercept	4.086	1	7.650	.008
Pretest_self-efficacy	28.368	1	53.108	.000
Group	3.266	1	6.114	.017
Total	28.844	54		
Corrected Model	29.012	2	48.091	.000
Intercept	11.143	1	36.941	.000
Pretest_metacognitive	22.068	1	73.161	.000
Group	2.938	1	9.739	.003
Total	874.941	57		
Corrected Model	28657.671	2	82.405	.000
Intercept	1596.223	1	9.180	.004
Pretest_academic_achievement	27160.272	1	156.198	.000
Group	1270.901	1	7.309	.009
Total	223925.00	57		

Upon examining the table, it is possible to say that there is a statistically significant difference between the experimental and control groups in terms of post-test mean scores for self-efficacy, metacognitive skills, and academic achievement in mathematics when controlling for pre-test mean scores ($p<.05$). After controlling for the effect of the common variable on self-efficacy, metacognitive skills, and academic achievement in mathematics, the arithmetic mean and standard deviation values of the groups for the dependent variable were examined to determine in favor of which group the difference between pre-test and post-test mean scores existed. Table 5 presents the statistical data after controlling for the effect of pre-test scores of self-efficacy, metacognitive skills, and academic achievement in mathematics, which were determined as common variables.

Table 5

Covariance Analysis Results

				95% Confidence interval	
Variable	Group	Mean	df	Lower Bound	Upper Bound
Self-efficacy	Control	3.644	.136	3.371	3.916
	Experimental	4.123	.138	3.846	4.400
Meta-cognitive skills	Control	3.588	.103	3.382	3.794
	Experimental	4.050	.105	3.840	4.260
Academic Achievement	Control	52.465	2.449	47.555	57.374
	Experimental	61.912	2.492	56.915	66.908

As controlling for the effect of the common variable, it has been concluded that there is a statistically significant difference in favor of the experimental group in terms of self-efficacy, metacognitive skills, and academic achievement in mathematics test scores between the experimental and control groups. In light of these data, it is possible to say that the investigated use of growth mindset strategies in the study has a significant and positive impact on the self-efficacy, metacognitive skills, and academic achievement in mathematics of 8th-grade students in the experimental group.

For the self-regulation variable, the assumption of homogeneity of regression slopes required for ANCOVA was tested by examining the interaction effect between the group variable and the self-regulation pre-test scores. Since this interaction was found to be statistically significant, indicating a violation of the homogeneity of regression slopes assumption, ANCOVA was not considered appropriate for this variable. Accordingly, differences in self-regulation scores were analyzed using an independent samples t-test to compare post-test mean scores between the experimental and control groups, and a paired samples t-test to examine within-group changes from pre-test to post-test. Prior to conducting the t-tests, assumptions of normality and homogeneity of variances were examined using skewness–kurtosis values, the Shapiro–Wilk test, and Levene's test.

To determine whether there is a statistically significant difference between the pretest and posttest mean scores of Self-Regulation Scale for students in the experimental and control groups, a paired samples t-test was conducted. The results for the dependent groups t-test are presented in Table 6.

Table 6

Dependent Samples t-Test Results for Self-Regulation Scale Mean Scores of Experimental and Control Group Students

Group	Measurement	N	Mean (x̄)	SD (Ss)	t	p
Experimental	Pretest	28	3.8730	0.58225	-3.726	0.001
	Posttest		4.5317	0.70231		
Control	Pretest	29	3.7625	0.73746	-0.878	0.388
	Posttest		3.8736	0.74756		

Upon examining Table 6, a statistically significant difference at the $p < .05$ significance level is observed between the pretest and posttest Self-Regulation scores for the experimental group, indicating an increase in Self-Regulation Scale mean scores after the implementation. Conversely, no increase is observed in the Self-Regulation Scale pretest and posttest mean scores for the control group.

The results of the independent group t-test for the Self-Regulation Scale mean scores between the experimental and control groups for pretest and posttest scores, determining whether there is a significant relationship, are presented in Table 7.

Table 7

Independent Samples t Test Results for Self-Regulation Scale Mean Scores between Experimental and Control Groups' Posttest Scores

Measurement	Group		Mean (x̄)	df	**t**	**p**
Posttest	Experimental	28	4.5317	0.70231	-3.427	0.001
	Control	29	3.8736	0.74756		

Upon examining Table 7, no significant difference at the 0.05 significance level is observed between the experimental and control groups in terms of the Self-Regulation Scale pretest mean scores, while a significant difference is observed in posttest scores. In other words, statistically significant differences in favor of the experimental group have emerged in the Self-Regulation Scale total mean scores after the intervention.

Prior to the intervention, the equivalence of the experimental and control groups in terms of mindset beliefs was examined. Since the pre-test scores of the Mindset Scale did not meet the normality assumption, the Mann–Whitney U test was used. The results indicated no statistically significant difference between the experimental and control groups' pre-test mindset belief scores ($U = 436.00$, $p = .631$), suggesting that the groups were comparable before the intervention.The results of the Mann-Whitney U test are presented in Table 8.

Table 6

Mann Whitney-U Test Results for Pretest Mean Scores of Mindset Scale for Experimental and Control Groups

Group	N	Rank Mean	U	p
Experimental	28	30.07	436.00	.631
Control	29	27.97		
Total	57			

According to Table 8, there is no significant difference in pretest mindset belief mean scores between the experimental and control groups (U=436.00, p=.631 > .05). These results indicate that the experimental and control groups were similar in terms of mindset belief before the intervention.

Table 7

Mann Whitney-U Test Results for Posttest Mean Scores of Mindset Scale for Experimental and Control Group

Group	N	Rank Mean	Rank Sum	U	p
Experimental	28	35.20	1067.50	579.50	0.006
Control	29	23.02	585.50		
Total	57				

According to Table 9, there is a significant difference in posttest mindset belief mean scores in favor of the experimental group (U=579.50, p=.006 < .05). These results suggest that the experimental and control groups differed in terms of mindset belief after the intervention.

Based on these findings, it can be concluded that the use of growth mindset strategies had a significant and positive effect on the mindset beliefs of 8th-grade students in the experimental group compared to the control group after the intervention.

Within the scope of the research, semi-structured interviews were conducted with six students from the experimental group prior to the 8-week growth mindset–based intervention. The qualitative data were analyzed using thematic content analysis, which involved open coding, the grouping of codes into categories, and the identification of overarching themes. The findings derived from the codes, categories, and themes identified before the intervention are presented in Table 10.

Table 8

Codes and Sub-themes related to the Pre-Implementation Process

Sub-themes	Codes	Example Student Statements
Strategies	Practice	S1: "I try to do the exercises our teacher gives us every day. It helps reinforce what we've learned. Solving math exercises is especially fun for me!"
	Structured Study	S4: "To be successful, I try to create a structured study routine every day. I do my assignments first, then allocate time for other activities. This way, I enjoy and progress step by step towards success."
		S3: "To achieve big goals, taking small steps is important. Planning my day and setting goals guide me toward success."
	Teacher Support	
	Active Participation	S5: "Being active in class makes learning more enjoyable. Asking questions and participating in class discussions help me understand topics better."
	Subject Review	S1: "Reviewing topics prevents us from forgetting what we've learned. Going over challenging topics reinforces my knowledge."
		S6: "Reviewing topics during exam preparation gives me confidence. It makes me feel more comfortable during exams."
Challenges	Difficulty Understanding	S2: "Some topics can be really confusing. Understanding everything can be challenging."
	Language Barrier	S3: "Learning a new language or word can be tough. Not being able to express everything properly bothers me. Due to language issues, I might find it difficult to understand math questions."
	Low Motivation	S5: "Some days I just don't feel like doing anything. Finding motivation can be challenging sometimes."
		S1: "I find it hard to see why I need to learn a particular topic. I want to understand why it's important."
	Difficulty Setting Goals	S3: "Setting a goal and focusing on it can be challenging. I don't know what my goal should be."
	Attention Distraction	S4: "Focusing becomes difficult when there's too much going on. I sometimes struggle to concentrate when the surroundings distract me."
		S2: "Concentrating in class can be impossible. Things around me can be distracting."
Attributions	Interest	S1: "The most important thing for me is learning about topics I'm interested in. I love science classes because exploring nature truly excites me. This interest makes my learning process more enjoyable."
	Self-Discipline	S6: "Successful people put a lot of effort into reaching their goals and work disciplinedly according to their plans."

	Focus	S4: "During exam preparation, I prefer turning off my phone and working in a quiet environment. This helps me focus better. When focused, I understand topics better, making success easier to achieve."
	Study Habits	S2: "Working regularly at a specific time every day is crucial for me. Also, keeping my class notes organized and reviewing what I've learned contributes to my success. Study habits serve as a guide for me to reach my goals."
	Overcoming Challenges	S1: "When facing a challenge, I try to turn it into an opportunity instead of giving up. Facing challenges makes me stronger, and I see them as opportunities, not obstacles, on my path to success."
	External Motivation	S3: "External motivation can be important for me. For example, praise from my family or teacher when I perform well in exams motivates me even more. This support becomes a driving force for reaching my goals."
Expectations	Increasing Achievement	S3: "I believe the education we will have with you will teach us new things. I expect to gain new knowledge, study, and success improvement tips."
	Overcoming Learning Difficulties	S4: "I don't have much idea about the content of the education we will attend, but apparently, we will gain new skills. That's what I think."
	Acquiring New Skills	S3: "I don't have much idea about the content of the education we will attend, but apparently, we will gain new skills. That's what I think."
	High Academic Achievement	S1: "This year, I aim to get a higher grade in math. I plan to pass every class by studying regularly and preparing better for exams. My goal is to improve myself and be successful in classes."
Learning Goals	Unclear Goals	S3: "I generally aim to be a better student. I want to do better in my classes, but I don't exactly know what I should do. Maybe I should study more regularly or seek more help from my teacher. My goal is a bit unclear, but I want to bring everything together and be a better student."

During the 4th week of the 8-week developmental mindset training conducted within the scope of the research, semi-structured interviews were conducted with 4 students from the experimental group. The findings related to the codes-categories-themes reached through content analysis of the data obtained from these interviews are presented in Table 11.

Table 11

Codes and Sub-themes related to the Implementation Process

Theme	Code	Example Student Statement
Goal Setting	Conscious Goal Setting Uncertainty Non-academic Goals SMART Goals	S7: "I determine what subjects I want to improve every year. It motivates me because my goal shows me where to focus." S9: "Sometimes, I'm indecisive about which goal to choose. I want to do good things, but I don't exactly know how." S8: "My goal is to be really good at soccer. I spend most of my time on it, so I can't really focus on my lessons anyway." S10: "My goal this year is to increase my overall grade at the end of each semester by a certain point. It helps me track my progress."
Experiences	Understanding Mindsets Self-awareness Transformation Motivation	S8: "I realized I have a negative mindset in a challenging subject. However, knowing that this mindset holds me back is a starting point for developing a more positive attitude." S10: "While working on a project, I realized that failure made me stronger. Now, I have a more optimistic perspective on dealing with challenges and learning." S7: "Initially, working on a project seemed daunting, but my teacher always says, 'you can do it.' Now, just believing that I can do it makes things easier." S8: "I'm not as good as others in some subjects. So, sometimes, I feel inadequate. But my teacher says everyone has strengths and weaknesses. Now, I'm trying to overcome this feeling by putting more effort." S8: "Sometimes, I lack confidence in exams. But my teacher says, when I'm prepared, I can succeed. Now, I'm trying to overcome this issue by working harder and believing in myself." S7: "When I struggle, my teacher always says, 'as long as you make an effort, you can succeed.' Now, I know that making an effort and working are important first."
Perspective on Intelligence and Ability	Power of Effort Belief in Development Everyone Can Learn	S8: "I used to struggle in math and feel untalented. But now, I really believe that I can improve if I make an effort in education." S9: "Even though my friend seems to learn faster, everyone has different abilities. I learn at my own pace, and the idea that everyone can learn motivates me."

The table summarizes the codes and example student statements related to the themes identified during the implementation process.

The semi-structured interviews were conducted with 5 students from the experimental group after the developmental mindset intervention. The findings related

to the codes-categories-themes reached through content analysis of the data obtained from these interviews are presented in Tablo 12.

Table 12

Codes and Sub-themes related to the After Implementation Process

Theme	Codes	Example Student Statements
Mindset	Challenge Seeking Mindset Awareness Growth Mindset Mastery-oriented Goals	S13: "When choosing a project, I usually go for the challenging ones. Because my teacher says challenging tasks will help us develop more. So, I focus more on challenging tasks." S12: "You mentioned understanding our mindset is important. Now, I better understand in which subjects I struggle and how I can improve."
Self-Efficacy	Sense of Competence Confidence	S15:"When I think I'm successful in a subject, I feel more competent. This motivates me to be successful in other subjects too."
Motivation	Increased Interest - Motivation Active Participation Resilience Increased Success	S11:"My teacher conducted an interesting experiment in this regard, and it really impressed me. Now, I'm more interested in this topic, and I participate more actively in class." S14:"I decided to participate in a competition, and it motivated me to study more. I'm working hard to achieve my goal and focusing more on learning in the process."
Self-Regulation	Conscious Goal Setting Focusing SMART Goals Guidance Need Planning	S13: "When I turn off my phone and focus only on my studies, I understand better. I've decided to distance myself a bit more from social media. Focusing makes my learning process more effective."
Metacognition	Recognizing Barriers Analytical Thinking	S11:"When learning a difficult subject, I try to understand why I'm struggling. This helps me recognize barriers to becoming a better student."

This table provides an overview of the codes and example student statements in each category, offering a clearer representation of the impact of the intervention on students.

Observations conducted before the implementation indicate that the teacher's effective communication skills have contributed to the efficient processing of the mathematics lesson. Although students do not show a significant effort to achieve learning goals, their positive behaviors within the class are noticeable. The initial findings of the researcher reveal a highly positive classroom environment, where expected teacher and student behaviors are observed. However, the researcher's field notes and ongoing observations in the following weeks suggest that the pre-implementation observation activity has created an observer effect on the participants. Initial observations indicate that teachers and students do not behave naturally, leading

to observation findings that differ from their actual behaviors. Throughout the implementation process, the observation results can be summarized as follows:

Observations during implementation show that there is a significant change in students who do not make simultaneous efforts to make an effort. Students have begun to see making mistakes as a normal situation and start to consider mistakes as an opportunity for learning. However, it is observed that the high noise level in the class reduces the willingness of some students to make mistakes. Teacher-student communication is generally easily established. At the beginning of the process, the efforts of passive students to actively participate in the lesson stand out. This situation has made a difference, especially for students who are not interested in the lesson and lead to disciplinary problems. Students who started making an effort for academic success positively influenced each other.

Post-implementation observations indicate that students have experienced positive changes in effort, study habits, and motivation. The teacher's effective communication and guidance have enabled students to actively participate in the learning process and create a positive atmosphere in the class. To sustain these changes, it is important to provide support and encouragement to students, increase in-class interaction, and maintain a focus on success. The teacher used communication strategies effectively in the first week, but in the subsequent process, effective communication was only established with students who actively participated in the lesson. Compared to the initial weeks of observation, the teacher has chosen a more effective communication language in providing clear information about learning goals to students in the final weeks.

Discussion and Conclusions

The research findings indicate that variables such as self-efficacy, self-regulation, metacognitive skills, academic achievement, and mindset beliefs have been explored. These findings are discussed in relation to the relevant literature based on each dependent variable. In this context, the discussion section aims to address the impact of growth mindset strategy use on each variable separately, including self-efficacy, self-regulation, metacognitive skills, academic achievement, and mindset beliefs.

Self-Efficacy

Several studies (Bai et al., 2020; Blackwell et al., 2007; Palazzolo, 2016; Yeager & Dweck, 2012) demonstrate the positive impact of growth mindset interventions on self-efficacy.These studies emphasize that growth mindset–oriented educational practices strengthen individuals' beliefs in their capacity to succeed by attributing achievement to effort rather than fixed ability. Empirical evidence shows that students who participate in growth mindset interventions tend to report higher levels of self-efficacy, particularly in academically demanding domains such as mathematics (Bai et al., 2020; Paunesku et al., 2015).

The findings of the present study align with this body of research, indicating that students in the experimental group demonstrated significantly higher self-efficacy levels compared to their peers in the control group. However, the contribution of the current research extends beyond replication. By focusing on socioeconomically disadvantaged

students within a high-stakes examination context, the findings highlight that growth mindset strategies may serve as a compensatory psychological resource for students who are structurally exposed to academic risk. Qualitative data further support this interpretation, as students frequently associated effort, persistence, and coping with challenges with their perceptions of success. Consistent with previous research (Rhew et al., 2018; Schwarzer, 2014), students who expressed growth-oriented beliefs tended to interpret challenges as opportunities for learning rather than threats, indicating a close connection between growth mindset and self-efficacy development.

Moreover, these findings can be interpreted within Bandura's conceptualization of self-efficacy as a domain-specific belief system that shapes individuals' effort, persistence, and responses to failure (Bandura, 1986, 1997). Self-efficacy is strengthened particularly through effortful engagement with challenging tasks, whereas efficacy beliefs derived from easily attained success tend to be fragile in the face of adversity (Bandura, 1995). In this respect, growth mindset orientations appear to foster more adaptive efficacy beliefs, as students who endorse incremental views of intelligence are more likely to interpret peers' success as attainable and to persist following setbacks, while those with fixed mindsets often perceive others' achievement as threatening and disengage when confronted with difficulty (Rhew et al., 2018; Schwarzer, 2014). Prior research further indicates that academically struggling students typically exhibit lower intrinsic motivation and self-efficacy (Chow & Yong, 2013; O'Shea et al., 2017; Safree et al., 2009), a pattern that is especially pronounced among socioeconomically disadvantaged learners as they progress through secondary school (Li & Lerner, 2011; Wang & Degol, 2014; Wigfield et al., 2006). However, growth mindset interventions have been shown to positively influence students' beliefs about effort and achievement, particularly in mathematics, thereby shaping future academic choices and engagement (Romero et al., 2014). Empirical evidence also suggests that the use of growth mindset strategies contributes to improvements in academic self-efficacy (Burnette et al., 2013; McWilliams, 2015; Samuel & Warner, 2021), with students demonstrating stronger internal attributions and more robust efficacy beliefs (McWilliams, 2015), a trend corroborated by PISA 2018 findings (Schleicher, 2019). Given that self-efficacy is a key predictor of academic motivation and perseverance (Zimmerman, 2000), and that higher self-efficacy is associated with greater self-regulation and sustained effort (Komarraju & Nadler, 2013), the present results suggest that growth mindset practices may operate as a critical psychological lever for enhancing resilience and academic agency among students facing structural disadvantage.

Self-Regulation

Growth mindset has been widely conceptualized as a motivational construct closely linked to self-regulation processes (Dweck, 2006; Zhao et al., 2021). Prior research suggests that individuals who believe abilities can be developed are more likely to engage in adaptive learning behaviors, including planning, monitoring, and sustaining effort (Chen & Pajares, 2010; Da Fonseca et al., 2008; Mueller & Dweck, 1998; Shih, 2011). These behaviors constitute the core components of self-regulated learning.

The results of the present study demonstrate that growth mindset strategy use had a significant positive effect on students' self-regulation skills. When pre-test

differences were controlled, students in the experimental group exhibited higher self-regulation scores than those in the control group. This finding supports previous evidence suggesting that growth mindset interventions encourage students to persist in challenging tasks and apply more effective learning strategies (Blackwell et al., 2007; Mrazek et al., 2018; Zeng et al., 2016). Importantly, the current study contributes to the literature by empirically demonstrating this relationship in a socioeconomically disadvantaged middle school sample, a group that has been underrepresented in prior research conducted within the Turkish educational context.

Furthermore, accumulating evidence suggests that growth mindset and self-regulation mutually reinforce one another through goal-setting, strategy selection, and goal-monitoring processes (Zhao et al., 2021). Students' beliefs about intelligence have been shown to activate and strengthen self-regulatory skills (Wang et al., 2019), while awareness of one's own cognitive development is essential for internalizing growth mindset messages, a process that itself relies on self-regulatory capacity (Wang et al., 2021). Longitudinal findings indicate a positive reciprocal relationship between growth mindset and the development of self-regulation (Job et al., 2015), with implicit beliefs guiding students' willingness to learn self-regulatory strategies (Karlen et al., 2021). From a goal-oriented perspective, growth mindset promotes mastery-oriented goal setting driven by intrinsic learning motives, whereas fixed mindset is associated with performance-oriented goals aimed at proving ability (Maurer, 2023). Similarly, individuals with a growth mindset tend to adopt mastery-focused strategies when pursuing goals, while those with a fixed mindset are more likely to engage in avoidance-oriented responses to difficulty (Henderson & Dweck, 1990). During goal monitoring, growth-oriented students display greater optimism and persistence (Dweck & Yeager, 2018), whereas fixed mindset is linked to negative affect and disengagement (Burnette et al., 2013). Empirical studies further demonstrate that growth mindset predicts lower learning-related anxiety (Da Fonseca et al., 2008), greater persistence in challenging tasks (Mueller & Dweck, 1998), constructive learning behaviors (Shih, 2011), increased use of self-regulatory strategies (Chen & Pajares, 2010), and higher academic goal setting (Blackwell et al., 2007). Recent evidence from students affected by the COVID-19 pandemic also indicates a positive association between growth mindset and self-regulation, highlighting its role in sustaining planning and goal commitment under adversity (Jiang et al., 2023). Moreover, individuals with a growth mindset report fewer negative emotions following failure, greater optimism about future goals, and less avoidance, underscoring the co-development of growth mindset and self-regulatory capacity (Burnette et al., 2020).

Metacognitive Skills

Metacognitive skills, defined as the ability to plan, monitor, and evaluate one's own learning processes (Flavell, 1987; Zimmerman & Moylan, 2009), are closely related to both self-regulation and growth mindset beliefs. A growth mindset emphasizes learning as a process driven by effort and strategy use rather than fixed ability (Dweck, 2006), a perspective that aligns conceptually with metacognitive regulation. Research indicates that students who effectively use metacognitive strategies are more likely to achieve academic success, particularly in cognitively demanding subjects such as mathematics (Wang et al., 2021).

The quantitative findings of the current study reveal that students exposed to growth mindset strategies demonstrated significantly higher metacognitive skill levels than those in the control group. This finding supports earlier work suggesting that growth mindset interventions facilitate students' engagement in strategic learning behaviors (Bai et al., 2020; Schraw et al., 2006). Moreover, qualitative findings indicate that students reported changes in study habits, effort regulation, and awareness of learning strategies following the intervention. These results suggest that growth mindset strategies may indirectly foster metacognitive development by encouraging students to reflect on their learning processes and adopt more adaptive strategies.

In addition, the relationship between growth mindset and metacognitive skills can be interpreted within a broader self-regulated learning framework. Pintrich (2000) emphasizes that students' goal orientations shape their strategic regulation processes, suggesting that mastery-oriented beliefs—conceptually aligned with growth mindset (Dweck, 2006)—promote deeper cognitive and metacognitive engagement. Similarly, Bai et al. (2020) describe growth mindset as a motivational construct theoretically compatible with metacognitive regulation and predictive of learning processes. Recent findings further indicate that the effectiveness of growth mindset interventions may depend on the presence of adequate metacognitive skills, particularly among students from low socioeconomic backgrounds (Wang et al., 2021). In this regard, the observed increase in both metacognitive skills and classroom engagement in the present study may reflect a reciprocal interaction in which growth-oriented beliefs stimulate strategic regulation, and enhanced metacognitive awareness, in turn, sustains adaptive motivational patterns (Hong et al., 1999; Kachnowski, 2019).

Academic Achievement

Academic achievement is one of the most frequently examined outcomes of growth mindset interventions (Claro et al., 2016; McCutchen et al., 2016; OECD, 2020; Savvides & Bond, 2021; Sisk et al., 2018). The literature emphasizes that growth mindset does not influence achievement solely through cognitive pathways but also by enhancing motivational and emotional processes that support sustained engagement (Canning & Limeri, 2023). Meta-analytic findings indicate that growth mindset interventions are particularly beneficial for students facing academic risk, including those from socioeconomically disadvantaged backgrounds (Savvides & Bond, 2021).

In the present study, mathematics achievement was selected as the primary academic outcome due to its critical role in the Turkish education system and its frequent association with fixed ability beliefs (Becker, 1981; Boaler, 2002; Çatalbaş & Susam, 2022). The findings demonstrate that growth mindset strategy use led to a significant improvement in mathematics achievement among students in the experimental group. This result provides context-specific evidence supporting international findings that growth mindset interventions can mitigate the negative effects of socioeconomic disadvantage on academic performance (Claro et al., 2016; OECD, 2019a). Qualitative data further suggest that increased effort, persistence, and resilience contributed to this improvement, reinforcing the notion that academic success can be enhanced by reshaping students' beliefs about effort and ability.

Furthermore, large-scale and meta-analytic evidence underscores that the relationship between growth mindset and academic achievement is shaped by contextual

and socioeconomic factors. OECD reports indicate that students who endorse growth-oriented beliefs tend to report higher levels of motivation and self-efficacy, both of which are positively associated with academic performance (OECD, 2020). Empirical studies have also demonstrated domain-specific links, particularly in mathematics achievement (McCutchen et al., 2016). Importantly, several interventions targeting academically at-risk and socioeconomically disadvantaged students have shown that growth mindset strategies can buffer the adverse effects of disadvantage by encouraging persistence and adaptive responses to challenge (Aronson et al., 2002; Burnette et al., 2013; Paunesku et al., 2015; Sarrasin et al., 2018; Yeager et al., 2014). Meta-analytic findings further confirm that these effects, while generally modest, are more pronounced among high-risk groups (Sisk et al., 2018; Savvides & Bond, 2021). In this respect, the present study's focus on a socioeconomically disadvantaged sample provides additional support for the argument that fostering growth-oriented beliefs may contribute to narrowing achievement gaps by strengthening students' effort beliefs and academic engagement (Claro et al., 2016).

Mindset Beliefs

Mindset beliefs constitute the core target of growth mindset interventions, as they shape how individuals interpret success, failure, and effort (Yeager & Dweck, 2020). Research consistently shows that interventions promoting the malleability of intelligence lead to more adaptive motivational patterns and long-term psychological benefits (Canning & Limeri, 2023; Sisk et al., 2018). Students with a growth mindset are more likely to view failure as informative and to persist in the face of challenges (Blackwell et al., 2007; Plaks & Stecher, 2007).

The findings of the current study indicate that growth mindset strategy use significantly improved mindset beliefs among students in the experimental group, while no such change was observed in the control group. Qualitative data revealed shifts toward valuing effort, embracing challenges, and perceiving intelligence as developable. In addition, classroom observations suggested that teacher feedback emphasizing effort and strategy use may have reinforced these changes, consistent with previous findings on the role of feedback in mindset development (Truax, 2017; Carpenter, 2018). Although the direct effect of feedback was not measured, the integration of teacher-focused guidance represents an important contextual contribution of the study.

Moreover, mindset change should be understood as a developmental process shaped by instructional messages delivered at critical periods. Mindset beliefs reflect individuals' implicit theories of intelligence (Yeager & Dweck, 2020), and interventions explicitly targeting the malleability of ability aim to restructure students' interpretations of effort and failure (Sisk et al., 2018). Such cognitive reframing is expected to generate enduring psychological benefits by promoting mastery-oriented goals and sustained motivation (Canning & Limeri, 2023). Empirical evidence suggests that students who believe intelligence can be developed are more likely to set learning goals, attribute success to effort, and persist strategically when confronted with setbacks (Blackwell et al., 2007; Dweck, 1999, 2006; Plaks & Stecher, 2007). In addition, psychologically attuned interventions delivered during sensitive developmental stages can strengthen these belief shifts (Walton & Wilson, 2018), which is particularly relevant for early adolescents whose mindset beliefs become increasingly stable over time (Farrington et

al., 2012; Yeager et al., 2013). In this respect, the present study's integration of teacher-oriented guidance and structured feedback practices may have provided a supportive ecological context that facilitated students' transition toward more adaptive mindset beliefs, aligning with the broader theoretical and empirical literature.

While the present findings indicate significant positive effects of the intervention, it is important to situate these results within ongoing debates in the growth mindset literature. Meta-analytic studies suggest that the overall effect sizes of growth mindset interventions are generally small to moderate and highly context-dependent (Sisk et al., 2018; Yeager & Dweck, 2020). The effectiveness of such interventions appears to vary according to implementation quality, student characteristics, and the broader instructional environment. In particular, research indicates that growth mindset interventions tend to produce stronger effects among academically at-risk and socioeconomically disadvantaged students, especially when embedded within supportive classroom practices (Yeager & Dweck, 2020). In this respect, the structured integration of teacher guidance and feedback practices in the present study may have contributed to the magnitude of the observed effects. These findings therefore support the view that growth mindset interventions are not universally transformative, but rather contextually sensitive and dependent on ecological alignment within the learning environment.

In conclusion, the findings of the present research indicate that growth mindset strategy use has a positive and meaningful impact on self-efficacy, self-regulation, metacognitive skills, academic achievement, and mindset beliefs among socioeconomically disadvantaged eighth-grade students. The originality of the study lies in its integrated examination of multiple interrelated outcomes within a critical educational transition period and a high-stakes examination context. By combining quantitative and qualitative evidence, the study contributes to the growing body of literature suggesting that growth mindset interventions can serve as an effective educational approach for supporting both academic and psychological development, particularly for students facing socioeconomic disadvantage.

Limitations

Several limitations should be considered when interpreting the findings of this study. First, the intervention lasted eight weeks, and no longitudinal follow-up data were collected; therefore, the long-term sustainability of the observed effects remains unknown. Future studies employing longitudinal designs would provide stronger evidence regarding the persistence of mindset-related changes. Second, although efforts were made to ensure implementation fidelity, the researcher's presence during observations and the preparatory guidance provided to the teacher may have introduced expectancy or observer effects. Third, qualitative findings rely on self-reported data, which may be subject to social desirability bias. Finally, as the study was conducted within a specific socioeconomically disadvantaged context, generalizability to different educational settings should be approached with caution.

References

Ahmar, F., & Anwar, E. (2013). Socio economic status and its relation to academic achievement of higher secondary school students. *IOSR Journal of Humanities and Social Science, 13*(6), 13-20. https://doi.org/10.9790/0837-1361320

Ahn, J., Luna-Lucero, M., Lamnina, M., Nightingale, M., Novak, D., & Lin-Siegler, X. (2016). Motivating students' STEM learning using biographical information. *International Journal of Designs for Learning, 7*(1). https://doi.org/10.14434/ijdl.v7i1.19409

Aslanargun, E., Bozkurt, S., & Sarıoğlu, S. (2016). Sosyo ekonomik değişkenlerin öğrencilerin akademik başarısı üzerine etkileri. *Uşak Üniversitesi Sosyal Bilimler Dergisi, 9*(27/3), 201-234.

Aronson, J., Fried, C. B., & Good, C. (2002). Reducing the effects of stereotype threat on African American college students by shaping theories of intelligence. *Journal of Experimental Social Psychology, 38*(2), 113-125. https://doi.org/10.1006/jesp.2001.1491

Bai, B., Wang, J., & Nie, Y. (2020). Self-efficacy, task values and growth mindset: what has the most predictive power for primary school students' self-regulated learning in English writing and writing competence in an Asian Confucian cultural context? *Cambridge Journal of Education*, 1–20. https://doi.org/10.1080/0305764X.2020.1778639

Barry, J. (2006). The effect of socio-economic status on academic achievement [Unpublished master dissertation]. Wichita State University, USA.

Becker, J. (1981). Differential treatment of females and males in mathematics classes. *Journal for Research in Mathematics and Education, 12*, 356–372. https://doi.org/10.2307/748657

Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child development, 78*(1), 246-263. https://doi.org/10.1111/j.1467-8624.2007.00995.x

Boaler, J. (2002). Learning from teaching: Exploring the relationship between reform curriculum and equity. *Journal for Research in Mathematics Education, 33*(4), 239–258. https://doi.org/10.2307/749740

Boyer, J. C., & Mailloux, N. (2015). Student teachers' self-perception of their mathematical skills and their conceptions about teaching mathematics in primary schools. *Procedia-Social and Behavioral Sciences, 174*, 1434-1442. https://doi.org/10.1016/j.sbspro.2015.01.772

Browman, A. S., Destin, M., Carswell, K. L., & Svoboda, R. C. (2017). Perceptions of socioeconomic mobility influence academic persistence among low socioeconomic status students. *Journal of Experimental Social Psychology, 72*, 45-52. https://doi.org/10.1016/j.jesp.2017.03.006

Burnette, J. L., O'Boyle, E. H., VanEpps, E. M., Pollack, J. M., & Finkel, E. J. (2013). Mind-sets matter: A meta-analytic review of implicit theories and self-regulation. *Psychological Bulletin, 139*(3), 655–701. https://doi.org/10.1037/a0029531

Canning, E. A., & Limeri, L. B. (2023). Theoretical and methodological directions in mindset intervention research. *Social and Personality Psychology Compass*, e12758. https://doi.org/10.1111/spc3.12758

Caro, D. H., McDonald, J. T., & Willms, J. D. (2009). Socio-economic status and academic achievement trajectories from childhood to adolescence. *Canadian Journal of Education/Revue canadienne de l'éducation, 32*(3), 558-590.

Carpenter, L. (2018). Feedback and growth mindset: Nurturing a growth mindset through feedback with middle school students [Unpublished masters thesis]. https://digitalcollections.dordt.edu/med_theses/123

Chen, J. A., & Pajares, F. (2010). Implicit theories of ability of grade 6 science students: Relation to epistemological beliefs and academic motivation and achievement in science. *Contemporary Educational Psychology, 35*(1), 75–87. https://doi.org/10.1016/j.cedpsych.2009.10.003

Chiu, M. M., & Chow, B. W. Y. (2015). Classmate characteristics and student achievement in 33 countries: Classmates' past achievement, family socioeconomic status, educational resources, and attitudes toward reading. *Journal of Educational Psychology, 107*(1), 152. https://doi.org/10.1037/a0036897

Chow, S. J., & Yong, B. C. S. (2013). Secondary school students' motivation and achievement in combined science. *Online Submission, 3*(4), 213-228.

Claro, S., Paunesku, D., & Dweck, C. S. (2016). Growth mindset tempers the effects of poverty on academic achievement. *Proceedings of the National Academy of Sciences, 113*(31), 8664-8668. https://doi.org/10.1073/pnas.1608207113

Creswell, J. W., & Clark, V. P. (2007). *Mixed methods research.* Thousand Oaks, *CA.*

Çakıoğlu, V., & Ergen, H. (2022). Ortaöğretime geçiş sistemine ilişkin öğretmen görüşlerinin incelenmesi. *IBAD Sosyal Bilimler Dergisi,* 13, 51-69. https://doi.org/10.21733/ibad.1099537

Çatalbaş, N. C., & Susam, E. (2022). Liselere Geçis Sisteminin (LGS) ortaokul matematik öğretmenlerinin görüşleri doğrultusunda incelenmesi. *İnönü Üniversitesi Eğitim Fakültesi Dergisi, 23*(3), 1482-1500. https://doi.org/10.17679/inuefd.1134613

Da Fonseca, D., Cury, F., Fakra, E., Rufo, M., Poinso, F., Bounoua, L., & Huguet, P. (2008). Implicit theories of intelligence and IQ test performance in adolescents with Generalized Anxiety Disorder. *Behaviour Research and Therapy, 46*(4), 529-536. https://doi.org/10.1016/j.brat.2008.01.006

De Fraja, G., Oliveira, T., & Zanchi, L. (2010). Must try harder: Evaluating the role of effort in educational attainment. *The Review of Economics and Statistics, 92*(3), 577-597.

Demir, N. (2019). *Ortaokul öğrencilerinin ders olarak matematiğe yönelik algılarının incelenmesi* [Unpublished Masters Thesis]. Yildiz Technical University, Turkey.

Demir, S. B., & Yilmaz, A. T. (2019). En iyisi bu mu? Türkiye'de yeni ortaöğretime geçiş politikasının velilerin görüşlerine göre değerlendirilmesi. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi, 19*(1), 164-183. https://doi.org/10.17240/aibuefd.2019.19.43815-445515

Delioğlu, H. N. (2017). *Sekizinci sınıf öğrencilerinin matematik başarısı ile sınav ve matematik kaygısı, matematiğe yönelik özyeterlik algısı arasındaki ilişki* [Master's thesis]. Adnan Menderes University, Turkey.

Dweck, C. S. (1999). Caution-praise can be dangerous. *American Educator, 23*, 4-9.

Dweck, C. S. (2006). *Mindset: The new psychology of success*. Random house.

Farrington, C. A., Roderick, M., Allensworth, E., Nagaoka, J., Keyes, T. S., Johnson, D. W., & Beechum, N. O. (2012). Teaching adolescents to become learners: The role of noncognitive factors in shaping school performance--A critical literature review (ED542543). ERIC. https://files.eric.ed.gov/fulltext/ED542543.pdf

Flavell, J. H. (1987). Speculations about the nature and development of meta-cognition. *Metacognition, Motivation, and Understanding*, 21-29.

Hart, K. M. (1980). Secondary school children's understanding of mathematics. A report of the mathematics component of the concepts in secondary mathematics and science programme (ED237363). ERIC. https://eric.ed.gov/?id=ED237363

Hong, Y. Y., Chiu, C. Y., Dweck, C. S., Lin, D. M. S., & Wan, W. (1999). Implicit theories, attributions, and coping: A meaning system approach. *Journal of personality and social psychology, 77*(3), 588.

Job, V., Walton, G. M., Bernecker, K., & Dweck, C. S. (2015). Implicit theories about willpower predict self-regulation and grades in everyday life. *Journal of Personality and Social Psychology*, *108*(4), 637.

Kachnowski, K. (2019). *The link between mindset, self-efficacy for self-regulated learning, and metacognitive learning strategies* [Unpublished Doctoral dissertation]. The Ohio State University, USA.

Karadag, E., & Karadeniz, İ. (2014). Kırsal bölgelerdeki ortaokul öğrencilerinin matematik kaygı ve tutumları: korelasyonel bir araştırma. *Turkish Journal of Computer and Mathematics Education (TURCOMAT), 5*(3), 259-273.

Karlen, Y., Hirt, C. N., Liska, A., & Stebner, F. (2021). Mindsets and self-concepts about self-regulated learning: Their relationships with emotions, strategy knowledge, and academic achievement. *Frontiers in Psychology*, *12*, 661142. https://doi.org/10.3389/fpsyg.2021.661142

Kılıç, Ç. (2015). *İlköğretim 5. sınıf matematik dersinde Van Hiele düzeylerine göre yapılan geometri öğretiminin öğrencilerin akademik başarıları, tutumları ve hatırda tutma düzeyleri üzerindeki etkisi* [Unpublished Doctoral dissertation]. Anadolu University, Turkey.

Madland, D., & Bunker, N. (2011). *Middle-class societies invest more in public education: A stronger middle class is associated with higher levels of spending on education*. Center for American Progress.

McCutchen, K., Jones, M. H., Carbonneau, K. J., & Mueller, C. E. (2016). Mindset and standardized testing over time. *Learning and Individual Differences, 45*, 208-213. https://doi.org/10.1016/j.lindif.2015.11.027

McWilliams, E. C. (2015). *Self-efficacy, implicit theory of intelligence, goal orientation and the ninth grade experience*. Northeastern University.

Ministery of National Education. (2021). *2021 Liselere Geçiş Sistemi (LGS) merkezi sinavla yerleşen öğrencilerin performansi raporu*. https://cdn.eba.gov.tr/icerik/2021/07/rapor/No_17-LGS_2021-merkezi_yerlestirme_211730.pdf

Ministery of National Education. (2022). *2022 ortaöğretim kurumlarina ilişkin merkezi sinav raporu*. https://cdn.eba.gov.tr/icerik/2022/07/LGS_2022_2_Merkezi_Sinav_Performans.pdf

Mrazek, A. J., Ihm, E. D., Molden, D. C., Mrazek, M. D., Zedelius, C. M., & Schooler, J. W. (2018). Expanding minds: Growth mindsets of self-regulation and the influences on effort and perseverance. *Journal of Experimental Social Psychology, 79*, 164–180. https://doi.org/10.1016/j.jesp.2018.07.003.

Mueller, C. M., & Dweck, C. S. (1998). Praise for intelligence can undermine children's motivation and performance. *Journal of Personality and Social Psychology, 75*(1), 33. https://doi.org/10.1037/0022-3514.75.1.33

O'Shea, A., Booth, J. L., Barbieri, C., McGinn, K. M., Young, L. K., & Oyer, M. H. (2017). Algebra performance and motivation differences for students with learning disabilities and students of varying achievement levels. *Contemporary Educational Psychology, 50,* 80-96. https://doi.org/10.1016/j.cedpsych.2016.03.003

Organisation for Economic Co-operation and Development. (2019a). *PISA 2018: Insights and interpretations*. OECD Publishing, Paris. https://www.oecd.org/pisa/PISA%202018%20Insights%20and%20Interpretations%20FINAL%20PDF.pdf

Organisation for Economic Co-operation and Development. (2019b). *Education at glance 2019*. https://www.oecdilibrary.org/docserver/f8d7880den.pdf?expires=1586886222&id=id&accname=guest&checksum=B41FF42CD97F0E73A2FF8CD6B82F1020

Organisation for Economic Co-operation and Development. (2020). *"Growth mindset", in PISA 2018 results (Volume III): What school life means for students' lives*. OECD Publishing, Paris.

Palazzolo, S. (2016). *The relationship between mindset and self-efficacy in pre-service elementary teacher candidates teaching science, and its implications on science teaching* [Unpublished doctoral dissertation]. University of Windsor.

Paunesku, D., Walton, G. M., Romero, C. L., Smith, E. N., Yeager, D. S., & Dweck, C. S. (2015). Mindset interventions are a scalable treatment for academic underachievement. *Psychological Science, 26,* 784-793. https://doi.org/10.1177/0956797615571017

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82*(1), 33–40. https://doi.org/10.1037/0022-0663.82.1.33

Plaks, J. E., & Stecher, K. (2007). Unexpected improvement, decline, and stasis: A prediction confidence perspective on achievement success and failure. *Journal of Personality and Social Psychology, 93*(4), 667–684. https://doi.org/10.1037/0022-3514.93.4.667

Pokropek, A., Borgonovi, F., & Jakubowski, M. (2015). Socio-economic disparities in academic achievement: A comparative analysis of mechanisms and pathways. *Learning and Individual Differences, 42*, 10–18. https://doi.org/10.1016/j.lindif.2015.07.011

Pomerantz, E. M., & Ruble, D. N. (1997). Distinguishing multiple dimensions of conceptions of ability: Implications for self-evaluation. *Child Development, 68*(6), 1165–1180. https://doi.org/10.2307/1132299

Rhew, E., Piro, J. S., Goolkasian, P., & Cosentino, P. (2018). The effects of a growth mindset on self-efficacy and motivation. *Cogent Education, 5*(1), 1492337. http://dx.doi.org/10.1080/2331186X.2018.1492337

Samuel, T. S., & Warner, J. (2021). "I can math!": Reducing math anxiety and increasing math self-efficacy using a mindfulness and growth mindset-based intervention in first-year students. *Community College Journal of Research and Practice, 45*(3), 205-222. https://doi.org/10.1080/10668926.2019.1666063

Sarrasin, J. B., Nenciovici, L., Foisy, L. M. B., Allaire-Duquette, G., Riopel, M., & Masson, S. (2018). Effects of teaching the concept of neuroplasticity to induce a growth mindset on motivation, achievement, and brain activity: A meta-analysis. *Trends in Neuroscience and Education, 12,* 22-31. https://doi.org/10.1016/j.tine.2018.07.003

Savvides, H., & Bond, C. (2021). How does growth mindset inform interventions in primary schools? A systematic literature review. *Educational Psychology in Practice, 37*(2), 134-149. https://doi.org/10.1080/02667363.2021.1879025

Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting self-regulation in science education: metacognition as part of a broader perspective on learning. *Research in Science Education, 36*, 111–139. https://doi.org/10.1007/s11165-005-3917-8

Schwarzer, R. (2014). *Self-efficacy: Thought control of action*. Routledge.

Selvitopu, A., & Kaya, M. (2023). A meta-analytic review of the effect of socioeconomic status on academic performance. *Journal of Education, 203*(4), 768-780. https://doi.org/10.1177/00220574211031978

Shih, S.-S. (2011). Perfectionism, implicit theories of intelligence, and Taiwanese eighth-grade students' academic engagement. *J. Educ. Res., 104*, 131–142. https://doi.org/10.1080/00220670903570368

Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research, 75*(3), 417-453. https://doi.org/10.3102/00346543075003417

Sisk, V., Burgoyne, A., Sun, J.,Butler, J. & Brooke, M. (2018). To what extent and under which circumstances are growth mind-sets important to academic achievement? Two meta-analyses. *Psychological Science, 29*. https://doi.org/10.1177/0956797617739704

Suna, H. E. , Tanberkan, H. , Gür, B., Perc, M. & Özer, M. (2020). Akademik başarının yordayıcıları olarak sosyoekonomik durum ve okul türü. *Ekonomi Kültürü ve Toplum Dergisi*, (61), 41-64. https://doi.org/10.26650/JECS2020-0034

Süer, N. (2014). *Öz düzenleme becerilerinin TEOG sınavı üzerindeki etkisi* [Unpublished Master dissertation]. Yıldız Teknik Üniversitesi.

Tomul, E., & Savaşçı, H. S. (2012). Socioeconomic determinants of academic achievement. *Educational Assessment, Evaluation and Accountability, 24*(3), 175-187. https://doi.org/10.12691/education-1-10-7

Truax, M. (2017). The impact of teacher language and growth mindset feedback on writing motivation. *Literacy Research and Instruction, 57*, 1-23. https://doi.org/10.1080/19388071.2017.1340529

Ulusoy, B. (2020). 8. sınıf öğrencilerinin liselere geçiş sınavı (LGS)'na ilişkin algılarının metaforlar aracılığıyla incelenmesi. *Necmettin Erbakan Üniversitesi Ereğli Eğitim Fakültesi Dergisi, 2*(2), 186-202. https://doi.org/10.51119/ereegf.2020.5

Wang, M. T., Zepeda, C. D., Qin, X., Del Toro, J., & Binning, K. R. (2021). More than growth mindset: Individual and interactive links among socioeconomically disadvantaged adolescents' ability mindsets, metacognitive skills, and math engagement. *Child Development, 92*(5), e957-e976. https://doi.org/10.1111/cdev.13560

Walton, G. M., & Wilson, T. D. (2018). Wise interventions: Psychological remedies for social and personal problems. *Psychological Review, 125*(5), 617–655. https://doi.org/10.1037/rev0000115

Walton, G. M., & Yeager, D. S. (2020). Seed and soil: Psychological affordances in contexts help to explain where wise interventions succeed or fail. *Current Directions in Psychological Science, 29*(3), 219-226. https://doi.org/10.1177/0963721420904453

Yeager, D. S., & Dweck, C. S. (2012). Mindsets that promote resilience: When students believe that personal characteristics can be developed. *Educational Psychologist, 47*(4), 302–314. https://doi.org/10.1080/00461520.2012.722805

Yeager, D. S., Henderson, M. D., Paunesku, D., Walton, G. M., D'Mello, S., Spitzer, B. J., & Duckworth, A. L. (2014). Boring but important: A self-transcendent purpose for learning fosters academic self-regulation. *Journal of Personality and Social Psychology, 107*(4), 559–580. https://doi.org/10.1037/a0037637

Yüksel, M., & Ertürk, A. (2023). Türkiye'deki illerin sosyo-ekonomik gelişmişlik endeksine göre LGS fen ve matematik testleri ile LGS diğer alt test başarılarının karşılaştırmalı analizi. *Balıkesir Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 25*(2), 426-447.

Zeng, G., Hou, H. & Peng, K. (2016). Effect of growth mindset on school engagement and psychological well-being of Chinese primary and middle school students: The mediating role of resilience. *Frontiers in Psychology, 7*, 1873. https://doi.org/10.3389/fpsyg.2016.01873

Zhao, S., Du, H., Li, Q., Wu, Q., & Chi, P. (2021). Growth mindset of socioeconomic status boosts subjective well-being: A longitudinal study. *Personality and Individual Differences, 168*, 110301. https://doi.org/10.1016/j.paid.2020.110301

Zimmerman, B. J. & Moylan, A. R. (2009). Self-regulation: Where metacognition and motivation intersect. In D.J. Hacker, J. Dunlosky, & A.C.Graesser (Eds.), *Handbook of metacognition in education.* Routledge.

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