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An Examination of the Correlation between Growth Mindset, Grit, and Problem-Solving Skills

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Abstract

The growth mindset is founded on the notion that human attributes, including intelligence, talent, and personality, are adaptable and can be enhanced. The primary objective of this study is to investigate the correlation between growth mindset, grit, and problem-solving skills. The study was carried out in the academic year 2023-2024, including a sample of 437 students assigned to the 8th grade of a secondary school situated in the Efeler district of Aydın province. For data collection, the Problem Solving Inventory for Children, the Short Grit Scale, and the Growth Mindset Beliefs Scale were employed. An examination of the acquired data was conducted using the Mann-Whitney U test and Spearman correlation analysis. The study's findings revealed a notable correlation between students' growth mindset, grit, and problem-solving skills. Therefore, suggestions for further investigation were put forward based on these results.

Keywords: 8th grade students, growth mindset, grit, problem-solving skills.

Gelişen Zihin Yapısı, Azim ve Problem Çözme Becerileri Arasındaki İlişkinin İncelenmesi

Özet

Gelişen zihin yapısı kavramı, insana ilişkin zekâ, yetenek, kişilik gibi özelliklerin geliştirilebilir olduğu inancı üzerine inşa edilmiştir. Yapılan çalışmada, gelişen zihin yapısı, azim ve problem çözme becerileri arasındaki ilişkinin incelenmesi amaçlanmaktadır. Araştırma, 2023-2024 eğitim-öğretim yılında, Aydın ili Efeler ilçesinde bulunan bir ortaokulun 8. Sınıfında öğrenim gören 437 öğrenci üzerinde yapılmıştır. İlköğretim Düzeyindeki Çocuklar için Problem Çözme Envanteri, Kısa azim Ölçeği ve Gelişim Odaklı Zihniyet İnançları Ölçeği veri toplama aracı olarak kullanılmıştır. Elde edilen verilerin analizinde Mann –Whitney U test ve Spearman korelasyon analizi tekniği kullanılmıştır. Problem çözme becerisi ile azim, problem çözme becerisine güven ile gayrette ısrar arasında pozitif ilişkili olduğu bulunmuştur. Araştırmanın sonuçlarına göre, öğrencilerin gelişen zihin yapısı azim ve problem çözme becerileri arasında anlamlı ilişki olduğu sonucuna ulaşılmıştır. Bu sonuçlardan yola çıkarak gelecek araştırmalara yönelik önerilerde bulunulmuştur.

Anahtar Kelimeler: 8. sınıf öğrencileri, gelişen zihin yapısı, azim, problem çözme becerileri.

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INTRODUCTION

Adolescence is becoming increasingly significant, particularly in the field of preventive mental health, since it represents a transitional phase between childhood and adulthood characterized by the emergence of new adaptations (Yavuzer, 2005). Throughout adolescence, which is characterized as a period of transition from childhood to adulthood, numerous physical, cognitive, emotional, and social changes take place (Santrock, 2012). An significant developmental stage throughout adolescence is the acquisition of abstract thinking abilities, the emergence of new roles in relationships, and the incorporation of decision-making and choice-making capabilities (Kulaksızoğlu, 2020). During this dynamic era, characterized by concurrent changes in both physiological and psychological fields, individuals encounter various challenges that require resolution (Çam & Tümkaya, 2008).

Problem-solving skills, which refer to the ability to recognize the challenges encountered by an individual, generate solutions, implement these solutions, and assess the efficacy of the solutions (Reinecke et al., 2001), are crucial competencies for individuals. Problem-solving is a complex framework that involves multifaceted cognitive abilities including logical-creative thinking, analysis, synthesis, evaluation, sequencing, decision-making, research, and foresight (Teare, 2006). The problem-solving skills of individuals play a crucial role when confronted with challenges in their educational, personal, and professional growth and make a substantial contribution to their social-emotional development (Korkut, 2017).

Problems can be categorized into several classifications, including emotional, economic, and physical problems. These diverse sorts of problems can combine to create extensive and intricate problems (Cüceloğlu, 1997). Problem-solving is a deliberate, demanding, and purposeful process that entails creating reactions to interact with novel circumstances and selecting the best suitable reactions from a range of options. For effective issue-solving, it is crucial for individuals to possess problem-solving abilities and perceive the challenge they are facing as within their sphere of responsibility (Eskin, 2009).

This study aims to contribute to the literature by adding the variables of grit and growth mindset to various studies conducted on the relationship between problem-solving skills and critical thinking (Turgut et al., 2024), the moderating effect of authoritarian parenting style on the relationship between perfectionism and problem-solving (Eliüşük, 2024), the relationship between levels of digital game addiction (Bircan & Öner, 2022), the effect on mathematics achievement (Poçan et al., 2022), perceived autonomy support and critical thinking tendencies (Koçoğlu & Kanadlı, 2019), and the effect of intelligence games lessons on problem-solving and creative thinking skills (Epçaçan & Bahçeci, 2023).

The notion of 'Growth mindset,' derived from the attitude formulated by Carol S. Dweck (2000), who has conducted extensive research on the factors influencing the realization of potential in individuals,

has garnered significant interest from scholars in recent times. For students to become persons focused on learning in the 21st century, lifelong learners, and highly motivated, it is deemed crucial that they possess a growth mindset. Due to its significance, the notion of 'Growth Mindset' was introduced for the first time in PISA 2018, underscoring the requirement of the topic (OECD, 2019c).

A growth mindset is a set of beliefs that characteristics may be cultivated by systematic practice. Furthermore, persons who possess a growth mindset view abilities associated with embracing challenges, persevering in the presence of hurdles, exerting effort, and actively participating as means for acquiring knowledge (Dweck, 2012). Individuals' adoption of either a fixed mindset or a growth mindset significantly influences their ability to achieve their full potential. Within this framework, a fixed mindset is founded on a belief that the essential qualities of an individual are inherent and immutable, whereas a growth mindset is distinguished by the conviction that the essential qualities of an individual can be further developed (Dweck, 2000).

Several investigations conducted in the domains of psychology and neurology have yielded findings that substantiate the concept of the growth mindset. Multiple studies have demonstrated that the brain's plasticity, which refers to its ability to adapt and restructure itself in response to environmental and learning factors, grows with time. Furthermore, learning has been shown to greatly enhance human intelligence. Additionally, the exertion and perseverance shown by individuals when confronted with challenges play a crucial role in mental development (Jaeggi et al., 2008).

According to Esparza, Shurrow, and Schmidt (2014), students who possess a growth mindset are more inclined to actively pursue learning opportunities both inside and outside the classroom. They also consistently exceed the specified standards, demonstrate resilience in the face of challenges, perceive obstacles as chances for personal development, and effectively utilize feedback to enhance their overall performance. The OECD's (2021) report, titled "The Sky's the Limit: Growth Mindset in PISA, Students, and Schools," highlighted that students who possess a growth mindset place greater importance on education, demonstrate elevated levels of self-efficacy and motivation, and display reduced levels of fear of failure.

The presence of a growth mindset has a significant impact on individuals' willingness to participate in difficult activities and investigate many alternatives, therefore improving their problem-solving and critical thinking behaviors. These people are more inclined to approach issues with curiosity and persistence, look for several solutions, and take responsibility for their mistakes. When confronted with obstacles and difficulties, individuals who possess a growth mindset perceive these challenges as chances for acquiring knowledge, growing, and enhancing their skills. They are determined to accomplish their assignments (Suzuki et al., 2015) and make efforts to resolve problems (Blackwell et al., 2007).

Substantial research has been undertaken on the concept of "Growth Mindset" across several

fields, including psychology and education.These studies include the effect of growth mindset on reading skills (Altıntaş & Arıcı, 2021), the relationship between perseverance and growth mindset among professional athlete education students (Haleigh et al., 2022), the growth mindset in university students (Yılmaz & Güven, 2022), and the growth mindset in early childhood (Yalçın & Dinler, 2022). Our objective is to enhance the existing body of knowledge by incorporating grit and problem-solving abilities into the development of 8th-grade middle school studentsyoungsters. Additionally, we want to expand our understanding of how these talents can be applied in teaching methods.

Rather of retreating from work and struggle in the face of difficulties, a growth mindset encourages greater effort and a willingness to apply it. When faced with obstacles and setbacks, people who have a growth mindset don't view themselves as weak or incompetent; rather, they chalk it up to a lack of effort and work to get better, thinking that they can improve in any area if they put in enough drive, focus, and effort. These people take ownership of the steps that lead to achievement and view obstacles as opportunities for growth. People that have a growth mindset are notable for their dedication to their work, their ability to think critically, and their readiness and perseverance in imparting knowledge.

Grit, a foundational principle in positive psychology, refers to an individual's capacity to maintain both effort and motivation in pursuit of a desired long-term objective (Duckworth, 2016). Individuals exhibiting elevated levels of grit are more inclined to hold the belief that they have the ability to influence events in their lives and are prepared to exert immense effort in order to accomplish their objectives, even in the face of obstacles and challenges.

Grit can be characterized by two significant dimensions:

1. Consistency of interest: the desire to overcome challenges in a task, a strong sense of determination and resolve, an attachment to a particular purpose, and a long-term dedication to one's objectives.
2. Perseverance of effort: This describes the consistency of efforts (maintaining interest and effort, working diligently, finishing tasks that have been started, and enjoying the completion of duties), resisting for the goal even in difficult circumstances, and not giving up on the goal.

Individuals who possess grit are distinguished by their strong self-control, ability to resist desires, and unwavering commitment to future objectives. Across their academic, professional, and recreational pursuits, these individuals exhibit a strong determination and diligence in attaining the long-term objectives they have established for themselves (Duckworth et al., 2011). According to Diener and colleagues (2006), one of the key components of grit is an individual's capacity to adjust to changing circumstances when faced with challenges. In contrast to avoiding or delaying unpleasant situations, gritty individuals strive to address difficulties directly and proactively (Duckworth et al., 2007).

Gritty individuals are characterized by high self-control, resistance to impulses, and a focus on future goals. In their academic and professional pursuits, as well as in their leisure activities, they exert great effort and diligence to attain the long-term objectives they have established for themselves. They prioritize the task at hand, attach significant value to working with diligence, and hold the belief that their work should be of exceptional quality. Gritty individuals set long-term goals for themselves and do not give up on these goals even in the absence of positive feedback (Duckworth et al., 2007). They prioritize the aspects within their control in their life rather than those beyond their abilities to alter. They exert great effort to achieve the objectives they establish, are driven more by engagement in activities and discovering purpose in life rather than by the personal enjoyment they will experience, and are distinguished by a profound feeling of appreciation (Kleiman et al., 2013). They opt to manage persistent stressful circumstances as effectively as possible instead of avoiding or delaying them (Burkhart et al., 2014).

The participants of the study are middle school students. According to Yörükoğlu (1998), middle school is the transitional period between childhood and adolescent. Adolescence is a critical phase of development during which crucial choices are taken which will shape the individual's destiny. This research aims to examine how middle school student' growing mindsets affect their ability to solve problems and their persistence. The proficiency of middle school students in organizing and implementing problem-solving techniques when confronted with challenging circumstances is essential for successfully accomplishing the developmental targets required of them in both personal and societal domains.The work of psychological counselors encompasses the crucial task of providing students with the requisite abilities to proficiently employ problem-solving techniques in dealing with the challenges they face.

Problem-solving skills are recognized as a ground of academic and personal success, particularly during adolescence (Çam & Tümkaya, 2008; Korkut, 2017). Similarly, concepts such as growth mindset (Dweck, 2000, 2006) and grit (Duckworth, 2016) have attracted attention for their respective contributions to student achievement and well-being. Previous research has explored relationships between problem-solving skills and various factors like critical thinking (Turgut et al., 2024), parenting styles (Eliüşük, 2024), and mathematics achievement (Poçan et al., 2022), and has also examined growth mindset and grit in different contexts (e.g., Altıntaş & Arıcı, 2021; Haleigh et al., 2022; Yılmaz & Güven, 2022). However, while growth mindset and grit have been widely studied separately, their combined impact on problem-solving skills among middle school students remains underexplored. By focusing on this triadic relationship-growth mindset, grit, and problem-solving skills-the present study aims to bridge a crucial gap in educational psychology research. This research, therefore, explores to extend the existing literature by specifically investigating the interplay of growth mindset and grit in relation to the problem-

solving skills of 8th-grade middle school students. Understanding this combined effect is crucial, because middle school students' ability to effectively use problem-solving skills is key to meeting developmental targets in their personal and social domains (Yörükoğlu, 1998). The findings from this study are expected to aid in the strategic development and implementation of preventive guidance and psychological counseling initiatives designed to foster these crucial competencies.

METHOD

Participants

In order to ensure that the sample represents the population, the study was conducted with 8th-grade students of a large secondary school located in the Efeler region of Aydın province, which represents the population impartially. The total number of students to whom the survey was applied was 463, and with missing data analysis, 26 students were excluded from the analysis, leaving 437 students for the final analysis.

Data Collection Tools

The data in the study were collected using the Growth Mindset Beliefs Scale, Problem Solving Inventory for Children at the Level of Primary Education (PSIC) and The Short Grit Scale (Grit-S).

Growth Mindset Beliefs Scale

The "Growth Mindset Beliefs Scale," developed by Erdem & Yıldız (2023) with 9 items in a 6-point Likert format, involved 556 middle school students in the exploratory factor analysis (EFA) process and 657 middle school students in the confirmatory factor analysis (CFA) process. According to the pre-analysis of the EFA, the KMO value was found to be 0.848, and Bartlett's test of sphericity was significant at the 0.01 level ($\chi^2 = 1649.016$, df = 45, p = 0.00).

The results of the exploratory factor analysis indicated that the two-factor structure accounted for 55.233% of the total variance. The two-factor structure, labeled as fixed and developmental mindset concepts and consisting of 9 items, was confirmed by the CFA studies. The fit indices for the CFA showed that the two-factor, 9-item scale model had an excellent fit with PCMIN/DF = 2.452, GFI = 0.979, RMSEA = 0.047, CFI = 0.984, NFI = 0.974, IFI = 0.984, and a good fit with RMR = 0.058.

The Cronbach's alpha reliability coefficient for the entire scale was 0.85; for the first sub-dimension (growth mindset), it was 0.85, and for the second sub-dimension (fixed mindset), it was 0.81.

Problem Solving Inventory for Children at the Level of Primary Education (PSIC)

The Problem-Solving Inventory for Children (PSI-C) was developed by Serin et al. (2010) to assess problem-solving skills in primary school students. The inventory consists of 24 items and has three sub-

dimensions. The first sub-dimension, "Confidence in Problem-Solving Skills," includes 12 items. The second sub-dimension, "Self-Control," comprises 7 items. The third sub-dimension, "Avoidance," contains 5 items. Each item is rated on a five-point scale ranging from 1 (Never do this) to 5 (Always do this).

According to the results of the structural analysis conducted on the 24-item measurement tool, the inventory accounts for 42.26% of the total variance. Additionally, the results of the confirmatory factor analysis supported the three-factor model ($\chi^2/df = 2.49$, RMSEA = 0.051, GFI = 0.92, CFI = 0.90). The internal consistency coefficients were found to be 0.85 for Confidence in Problem-Solving Skills, 0.78 for Self-Control, and 0.66 for Avoidance. The test-retest reliability coefficients were 0.84 for Confidence in Problem-Solving Skills, 0.79 for Self-Control, and 0.70 for Avoidance.

The correlation coefficients calculated between the problem-solving scores for children were found to be 0.741 ($p < 0.001$) for the first sub-dimension, "Confidence in Problem-Solving Skills," 0.679 ($p < 0.001$) for the second sub-dimension, "Self-Control," and 0.478 ($p < 0.001$) for the third sub-dimension, "Avoidance." Since the item-test correlation coefficients obtained based on both items and factors were not negative, zero, or close to zero (Tavşancıl, 2005), it can be said that the tool has high internal consistency and, thus, structural validity.

The Short Grit Scale (Grit-S)

The Short Grit Scale (Grit-S) was developed by Duckworth and Quinn (2009). This scale covers 8 items and two subscales: consistency of interest (four items; e.g., “I often set a goal but later choose to pursue a different one”) and perseverance of effort (four items; e.g., “I am a hard worker”). Each item was rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). It was adapted to Turkish by Sarıçam et al. (2015). The goodness of fit index values of the model were ($\chi^2/df = 2.06$, RMSEA = .046, CFI = .95, GFI = .94, AGFI = .93, SRMR = .047). Cronbach's alpha internal consistency coefficient was found to be .83 for the whole scale, .80 for the sub-dimension of consistency of interest, and .71 for the sub-dimension of perseverance of effort. The test-retest reliability coefficient was .69 for the whole scale (Sarıçam et al., 2015).

RESULTS

Data analysis was conducted using the R programming language.

Missing Data Analysis

The rate of missing values for variables was calculated to be at most 8%. On the other hand, when the missing values for observations were examined, the number of observations that were not marked in at least one of the groups - Grit, Mindset, and PSS—was 26 (Observations: 28, 62, 75, 77, 101, 116, 183, 194, 216, 217, 224, 226, 231, 258, 267, 334, 338, 341, 360, 368, 370, 381, 393, 398, 429, 459), and these

observations were removed for accurate analysis results. In the missing observation analysis, it was tested whether the missing observations for variables were randomly distributed (MAR, MCAR, & MNAR) (Rouzinov S. & Berchtold A., 2020). The main reason for applying these tests is that the surveys were answered incompletely or incorrectly (Tierney NJ et al., 2015). Some variables have no missing values; that is, their result is -1. It is observed that the missing values are completely randomly distributed in almost all variables. The highest missing value rate was 8%. On the other hand, all 128 observations in the last table and mentioned in the previous section are completely randomly distributed. Due to the low rate of missing observations, they were filled with the rounded values of the variable means. There are 437 observations in the dataset with the removed observations.

Table 1. Confirmatory factor analysis

Measures	Test Statistics	Degrees of Freedom	p-values for Chi-Square	CFI	TLI	SRMR	RMSEA
Grit	51.909	19	<0.001	0.893	0.842	0.048	0.063
Mindset	129.809	26	<0.001	0.901	0.863	0.060	0.096
Problem Solving Skills	660.797	249	<0.001	0.848	0.832	0.066	0.062

In order to show a reasonably good fit in terms of variable groups in confirmatory factor analysis, RMSEA should be less than 0.08 and not greater than 0.1 (Browne & Cudeck, 1992). SRMR should be less than 0.08 (Hu & Bentler, 1999), and CFI and TLI values should be approximately close to 0.9 (Kim et al., 2016). According to the results of the sample surveyed, the factorization/grouping of Grit, Mindset, and Problem Solving Skills and their sub-groups are appropriate and compatible.

Table 2. Checking assumptions

Measures	Kurtosis	Skewness	Mean	Median	Mean/ Median	KS Test p-value
Grit	2.9	-0.25	28	28	1	0.077
Mindset	3.8	-0.94	40	42	0.95	<0.001
Problem S.Skill	3	-0.39	80	81	0.99	0.220
GrowthMindset	3.9	-1	23	24	0.94	<0.001
Fixed Mindset	3.2	-0.73	17	18	0.95	<0.001
Self confidence in their problem solving ability	2.9	-0.38	40	41	0.98	0.130
Self control	2.4	-0.044	22	22	1	0.009
Avoidance	3.2	-0.73	18	19	0.97	<0.001
Consistency of interest	2.7	-0.31	13	13	1	0.003
Perseverance of effort	2.8	-0.5	15	15	1	<0.001

For normality testing, according to the Kolmogorov-Smirnov test result, it was observed that seven variables did not comply with the normality assumption at the $\alpha = 0.05$ significance level. Therefore, the Mann-Whitney U test was used to compare group means.

Findings

Table 3. Spearman Correlation Analysis and Mann-Whitney U Test

Hypothesis	Measures	SpearmanRho	Spearman p-value	Mann-Whitney U p-value
H1	Problem Solving skills- Grit	0.487	<0.001	<0.001
	Self confidence in their problem solving ability (SCPSSA) – Consistency of interest	0.178	<0.001	<0.001
	(SCPSSA)- Perseverance of effort	0.425	<0.001	<0.001
	Self –control - Consistency of interest	0.371	<0.001	<0.001
	Self –control - Perseverance of effort	0.281	<0.001	<0.001
	Avoidance- Consistency of interest	0.374	<0.001	<0.001
	Avoidance - Perseverance of effort	0.379	<0.001	<0.001
H2	Mindset-- Problem Solving skills	0.250	<0.001	<0.001
	Mindset- Grit	0.148	0.002	<0.001
	Mindset – Self Control	0.174	<0.001	<0.001
	Mindset - Avoidance	0.153	0.001	<0.001
	Mindset - Consistency of interest	0.015	0.761	<0.001
	Mindset - Perseverance of effort	0.234	<0.001	<0.001
	Mindset - Self confidence in their problem solving ability	0.264	<0.001	<0.001

As seen in Table 3, according to the Mann-Whitney U test results for both Hypothesis 1 and Hypothesis 2, no significant relationship was observed between all groups at the $1-\alpha = 0.95$ confidence level (p-value < 0.001). According to the results of the Spearman correlation analysis, it is stated that PSS-Grit and self-confidence in their problem-solving ability, as well as perseverance of effort, have positive medium-sized relationships, and these relationships are significant. On the other hand, the relationships between other variables are positive and low-sized, and all relationships, except for the one between Mindset and Consistency of Interest (p-value = 0.761), are statistically significant (Schober et al., 2018).

DISCUSSION

The study reveals a significant positive relationship between a growth mindset and grit. This finding aligns with previous research that highlights a positive connection between a growth mindset and grit (Wang et al., 2018; Zhao et al., 2018; Jankay, 2020; Hochanadel & Finamore, 2015; Tang et al., 2019; Tucker-Drob et al., 2016; West et al., 2016). Students with a growth mindset are more likely to engage deeply with problems and persist in the face of difficulties or productive struggles (Dweck, 2010). This finding is consistent with the results of the current study.

Various studies (Blackwell et al., 2007; Hong et al., 1999) have found a relationship between a growth mindset and a tenacious approach to challenges. These findings support the results of the current study.

Individuals with advanced problem-solving skills are characterized by their flexibility, competence, and ability to develop alternative approaches when "stuck." They effectively use their knowledge and

explore alternative paths to make progress in the face of obstacles, demonstrating perseverance even when others might give up (Schoenfeld, 2007). Various studies have concluded that a growth mindset is effective in fostering effort (e.g., Miele et al., 2013), challenging situations (Porter et al., 2020; Yeager et al., 2019), and grit (Porter et al., 2020). Additionally, Zhao et al. (2018) found that a growth mindset predicts grit, with intrinsic motivation mediating this relationship. This finding supports the results of the current study.

The result that students with a growth mindset are more likely to engage deeply with problems and persist in the face of challenges or productive struggles (Dweck, 2010, 2013; Yeager et al., 2007) is consistent with the results of our study. Another study (Hochanadel & Finamore, 2015) found that having a growth mindset is an important component of grit. This finding supports the results obtained from our study. Students who believe in their ability to develop their skills are more likely to put in effort to grow, eventually achieve their goals, confront obstacles, and commit to increasingly challenging tasks. These characteristics and skills play a crucial role in a student's development in both academic and professional life. Individuals with a growth mindset can exhibit stronger growth in perseverance compared to their fixed mindset peers. This result is consistent with the findings of Blackwell et al. (2007).

The finding that there is a relationship between having a growth mindset and grit among high school and university students (Bettinger et al., 2018) supports the results of our study. Students with a growth mindset show positive relationships with various attitudes, such as motivation to tackle complex tasks (a tendency to seek more challenges), higher self-efficacy, setting more ambitious learning goals, and perceiving greater learning value.

Furthermore, it has been found that students with a growth mindset experience less fear of failure (OECD, 2021). The relationship between a growth mindset and grit is supported by various studies. Puente-Diaz and Cavazos-Arroyo (2017) found a positive relationship between a growth mindset and grit, emphasizing that a growth mindset is associated with a preference for 'progress indicators that emphasize learning and development.'

Additionally, a meta-analysis by Burnette et al. (2013) concluded that a growth mindset predicts self-regulation processes, which in turn predict effort, perseverance, and goal attainment. Duckworth's research highlights the importance of grit for performance (Duckworth, 2016). In this regard, a growth mindset may be an important factor in developing grit (Dweck, 2017).

The study by Sigmundsson et al. (2020a) found a significant relationship between grit and a growth mindset, supporting the findings of the current study. The result from Kannangara et al. (2018), which indicates that individuals with high grit scores are significantly more likely to have a growth mindset, supports the findings of the current study. Moreover, the findings from the current study align with the

results of Yalçın & Yılmaz (2023), which show a positive and significant relationship between the growth mindset dimension and grit among high school students.

According to Zeng et al. (2019), there is a relationship between individuals' growth mindsets and grit in effort, contributing to goal achievement, goal setting, processing goals, and tracking goals. Setting goals and persistently working towards achieving them is related to grit, and these results support the findings of the study.Persistent students work patiently and resolutely to achieve their goals (Duckworth et al., 2007). However, students with a fixed mindset may exert less effort to reach their goals, may not learn from their failures, and may give up (Dweck, 2006; Smith & Johnson, 2018).

Grit is the drive to achieve goals or solve difficult problems in the face of challenges and setbacks (Duckworth, 2016). According to Yeager and Dweck (2012), students with a growth mindset are able to increase their ability to overcome obstacles rather than giving up, which supports the findings of the current study.

Students with a growth mindset believe that they will be more successful academically in the future, which increases their learning performance, leads to higher expectations, and provides more motivation for academic success (Yeager & Dweck, 2012; Sisk et al., 2018). Students with a growth mindset are more likely to seek learning opportunities inside and outside the classroom, go beyond set requirements, persist in the face of challenges, view difficulties as opportunities, and use feedback appropriately for development. In contrast, students with a fixed mindset are at risk of adopting ineffective and inefficient learning models. Therefore, it is emphasized that teachers should conduct activities that promote a growth mindset (Esparza et al., 2014). Since individuals with a growth mindset possess characteristics that strengthen and develop through personal effort and practice, activities that support and enhance this mindset are crucial for nurturing a growth mindset.

Teachers play a significant role in creating an appropriate environment to develop students' growth mindsets, supporting the learning process, and providing constructive feedback. Educational programs that incorporate a growth mindset approach play a key role in the causal relationship between growth mindset and academic performance (OECD, 2021).

Conclusion

Nourishing the developing cognitive structure yields highly productive and effective results for individuals in both academic and personal-social domains. The potential risk of experiencing failure that could undermine one's self-confidence, or the increasing difficulty and unbearable nature of the steps required to achieve a goal, can lead individuals to give up. Therefore, coping strategies and activities aimed at enhancing self-confidence, self-control, and motivation should be utilized to prevent the

extinguishing of grit (Peterson & Seligman, 2004).

Among the developmental tasks expected to be completed by middle school students in the individual and social development areas, it is crucial for them to recognize and apply problem-solving strategies to address encountered problems.

In the scope of "Preventive Guidance" efforts, it is important to provide psychoeducational programs aimed at the educational and personal development of individuals, offer effective problem-solving strategies for students facing issues, implement programs in school environments that enhance problem-solving skills and perseverance, and develop group activities. The emphasis placed on the development of these skills in school programs will be a supporting factor for students in developing these attributes.

Teachers play a significant role in creating an appropriate environment to develop students' evolving cognitive structures, supporting the learning process through guidance, and providing constructive feedback. Teachers can acquire more detailed information about problem-solving skills, grit, and cognitive development, and can incorporate activities into their plans that provide rich experiences for developing these attributes in students.

Informational activities about activities that provide rich experiences for developing students' cognitive structures, grit, and problem-solving skills can be organized for teachers. Students' grit supports their growth mindset and can be enhanced through education (Gamel, 2014; Perez, 2015; Steinbeck, 2018). Trainings, activities, and projects aimed at enhancing students' grit can be organized.

Ethical Approval: The study protocol was approved by the Education Research Ethics Committee of Adnan Menderes University (Date: 07/09/2022; Reference Number: GO-2022/844). The study was conducted in accordance with the ethical standards outlined in the 1964 Declaration of Helsinki and its subsequent amendments.

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REFERENCES

Altıntaş, Ö. & Arıcı, Ö. (2021). Gelişen zihin yapısının okuma becerilerine içsel ve dışsal motivasyon kaynakları bağlamında etkisinin aracılık modelleriyle incelenmesi: PISA 2018 Türkiye örneği. *Ulusal Eğitim Akademisi Dergisi* (UEAD), *5*(2), 299-317.

Bettinger, E.; Ludvigsen, S.; Rege, M.; Sollic, I.F.; Yeager, D.S. (2018), Increasing perseverance in math: Evidence from a field experiment in Norway. *J. Econ. Behav. Organ.*, *146*, 1–15.

Bircan, M.A. & Öner, İ.E. (2022). Ortaokul öğrencilerinin dijital oyun bağımlılığı düzeyleri ile problem çözme beceri düzeyleri arasındaki ilişkinin incelenmesi. *Kırşehir Eğitim Fakültesi Dergisi, 23*(2), 1934-1959.

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

Burkhart, R. A., Tholey, R. M., Guinto, D., Yeo, C. J., & Chojnacki, K. A. (2014). Grit: A marker of residents at risk for attrition? *Surgery, 155*(6), 1014–1022.

Blackwell, L., Trzesniewski, K., & Dweck, C. (2007). "Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention." *Child Development, 78*(1), 246-263.

Browne, M. W., & Cudeck, R. (1992). Alternative ways of assessing model fit. *Sociological Methods & Research, 21*(2), 230–258.

Cüceloğlu, D. (1997). İnsan ve Davranış. 7. Basım. İstanbul: Remzi Kitabevi.

Çam, S. ve Tümkaya, S. (2008). Kişilerarası problem çözme envanteri lise öğrencileri formunun geçerlik ve güvenirlik çalışması. *Uluslararası İnsan Bilimleri Dergisi, 2*(5), 1703-1724.

Diener, E., Lucas, R., & Scollon, C. (2006). Beyond the hedonic treadmill: Revising the adaptation theory of well-being. American *Psychologist, 61*, 305-314.

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology, 92*(6), 1087–1101. https://doi.org/10.1037/0022-3514.92.6.1087.

Duckworth, A. L., & Quinn, P. D. (2009). Development and validation of the Short Grit Scale (GRIT–S). *Journal of Personality Assessment*, *91*, 166–174.

Duckworth, A. (2016). *Grit: The Power of Passion and Perseverance* (Vol. 234). New York, NY: Scribner.

Dweck, C. S. (2000). *Self-Theories: Their Role in Motivation, Personality, and Development*. Philadelphia, PA: Psychology Press.

Dweck, C. S. (2010). Even geniuses work hard. *Educational Leadership*, *68*(1), 16.

Dweck, C. S. (2012). *Mindsets and malleable minds: Implications for giftedness and talent.* In R. F. Subotnik, A. Robinson, C. M. Callahan, & E. J. Gubbins (Eds.), Malleable minds: Translating insights from psychology and neuroscience to gifted education (pp. 7-18). The National Research Center on the Gifted and Talented, University of Connecticut.

Dweck, C. S. (2017). The journey to children's mindsets—and beyond. *Child Development Perspectives*, 1–6.

Eliüşük, B. A. (2024). İlköğretim öğrencilerinin mükemmeliyetçilikleri ile problem çözme becerileri arasındaki ilişkide otoriter çocuk yetiştirme tutumunun düzenleyici etkisi. *Bingöl Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 27*, 262-272.

Epçaçan, U. & Bahçeci, F. (2023). Zekâ Oyunları Dersinin Problem Çözme ve Yaratıcı Düşünme Becerilerine Etkisi. *Anatolian Journal of Educational Leadership and Instruction, 1*(2), 342-361.

Erden, B., & Yıldız, S. (2023). Gelişim odaklı zihniyet inançları ölçeği geliştirme çalışması ve psikometrik özellikleri. *Bolu Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi, 23*(1), 98-117.

Eskin, M. (2009*). Temel kavram ve tanımlar: sorun çözme terapisi*. Ankara: HYB Basın Yayın.

Esparza, J., Shumow, L., & Schmidt, J. A. (2014). Growth mindset of gifted seventh-grade students in science. *NCSSSMST Journal, 19*, 6-13.

Haleigh, G.M., Moran, R., & Delfin, D. (2022). The Relationship Between Grit and Growth Mindset in Professional Athletic Training Students. Journal of Sports Medicine and Allied Health Sciences, *Official Journal of the Ohio Athletic Trainers Association, 8*(2), 2.

Hochanadel, A., & Finamore, D. (2015). Fixed and growth mindsets in education and how grit helps students persist in the face of adversity. *Journal of International Education Research, 11*(1), 47–50.

Hu, L., & Bentler, P. M. (1999). Cut-off criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1–55.

Jaeggi, S. M., Buschkuehl, M., Jonides, J., & Perrig, W. J. (2008). Improving fluid intelligence with training on working memory. *Proceedings of the National Academy of Sciences of the United States of America, 105*(19), 6829–6833.

Kannangara, C. S., Allen, R. E., Waugh, G., Nahar, N., Khan, S. Z. N., Rogerson, S., & Carson, J. (2018). All that glitters is not grit: Three studies of grit in university students. *Frontiers in Psychology, 9*, 1539.

Kim, H., Ku, B., Kim, J. Y., Park, Y. J., & Park, Y. B. (2016). Confirmatory and exploratory factor analysis for validating the phlegm pattern questionnaire for healthy subjects. Evid Based Complement Alternat Med.

Koçoğlu, A., & Kanadlı, S. (2019). Ortaokul öğrencilerinin algıladığı özerklik desteği, eleştirel düşünme eğilimleri ve problem çözme becerileri arasındaki ilişkisinin incelenmesi. *Trakya Eğitim Dergisi*, *9*(1), 61-77.

Korkut, F. (2017). *Okul temelli önleyici rehberlik ve psikolojik danışm*a. Ankara: Anı Yayıncılık

Kulaksızoğlu, A.(2020). *Ergenlik Psikolojisi*. İstanbul :Remzi Kitabevi

Kleiman, E. M., Adams, L. M., Kashdan, T. B. and Riskind, J. H. (2013). Gratitude and grit indirectly reduce risk of suicidal ideations by enhancing meaning in life: Evidence for a mediated moderation model.

Journal of Research in Personality, 47(5), 539-546.

OECD (2021). Sky's the Limit: Growth Mindset, Students, and Schools in PISA. PISA, OECD Publishing. https://www.oecd.org/pisa/growth-mindset.pdf.

OECD (2019 c). *PISA 2018 results (Volume III): What school life means for students' lives*. PISA, OECD Publishing. https://doi.org/10.1787/acd78851-en

Poçan, S., İlhan, A., & Gemcioğlu, M. (2022). The Effect of Problem Solving Skills Perception and Math Attitude on Mathematics Achievement: A Path Analysis Study for Secondary School Students. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi*, *62*, 86-104.

Porter, T., Martinus, A., Ross, R., Cyster, C. F., & Trzesniewski, K. (2020). Changing Learner Beliefs in South African Townships: An Evaluation of a Growth Mindset Intervention. *Social Psychological and Personality Science, 11*(7), 991–998.

Reinecke, M. A., DuBois, D. L. and Schultz, T. M.(2001). Social problem solving, mood and suicidality among ınpatient adolescents, *Cognitive Therapy and Research, 25*(6), 743-756.

Rouzinov, S., & Berchtold, A. (2020). RBtest: Regression-Based Approach for Testing the Type of Missing Data. R package version 1.1.

Santrock, J. W. (2012*). Ergenlik .* Çev.ed. Diğdem Müge Siyez . Ankara: Nobel Yayın.

Sarıçam, H., Çelik, İ., and Oğuz, A. (2016). Turkish Adaptation of the Short Grit Scale (Grit-S): Validity and Reliability Study. *International Journal of Turkish Literature Culture Education*, *5*(2), 927-935.

Serin, O., Serin, N. B., & Saygılı, G. (2010). İlköğretim düzeyindeki çocuklar için problem çözme envanterinin geliştirilmesi. *İlköğretim Online Dergisi*, 446-458.

Sigmundsson, H., Haga, M., & Hermundsdottir, F. (2020). The passion scale: Aspects of reliability and validity of a new 8-item scale assessing passion. *New Ideas in Psychology*, *56*, 100745.

Suzuki, Y., Tamesue, D., Asahi, K., & Ishikawa, Y. (2015). Grit and work engagement: A cross-sectional study. *PLoS One, 10*(9).

Schober, P.,M., Boer,C., Schwarte.,& Lothar A. (2018) . Correlation Coefficients: Appropriate Use and Interpretation. *Anesthesia&Analgesia, 126* (5),1763-1768.

Smith, J. K., & Johnson, M. J. (2018). Fixed mindset versus growth mindset: Which one do you have? *Journal of Education and Practice*, *9(*30), 45-51.

Tang, X., Wang, M. T., Guo, J., & Salmela-Aro, K. (2019). Building grit: The longitudinal pathways between mindset, commitment, grit, and academic outcomes. *Journal of Youth and Adolescence*, *48*, 850-863.

Teare, B. (2006). Problem-Solving and Thinking Skills Resources for Able and Talented Children. Network Continuum Education. London.

Tierney NJ., Harden FA., Harden MJ.& Mengersen KL.(2015) Using decision trees to understand structure in missing data. *BMJ Open. 29* : *5*(6).

Tucker-Drob, E. M., Briley, D. A., Engelhardt, L. E., Mann, F. D., & Harden, K. P. (2016). Genetically-mediated associations between measures of childhood character and academic achievement.

Journal of Personality and Social Psychology, 111, 790–815.

Turgut, H., Kılıç, F. E., Aycan, R., & Ünal, C. E. (2024). Ortaokul öğrencilerinin eleştirel düşünme ve problem çözme becerilerinin ölçümü: Bir analitik rubrik geliştirme çalışması. *Uluslararası Sosyal Bilimler ve Eğitim Dergisi*-USBED, *6*(10), 107-126.

Wang, S., Dai, J., Li, J., Wang, X., Chen, T., Yang, X., …, &Gong, Q. (2018). Neuroanatomical correlates of grit: Growth mindset mediates the association between gray matter structure and trait grit in late adolescence. *Human Brain Mapping*, 39(4), 1688–1699.

West, M. R., Kraft, M. A., Finn, A. S., Martin, R. E., Duckworth, A. L., Gabrieli, C. F., & Gabrieli, J. D. (2016). Promise and paradox: Measuring students' non-cognitive skills and the impact of schooling. *Educational Evaluation and Policy Analysis*, 38, 148– 170.

Yalçın, V. & Dinler, H. (2022). Growth mindset in early childhood: why and how?, *Inönü University Journal of the Faculty of Education*, *23*(1), 584-598

Yalçın, B. & Yılmaz, E.(2023). Study on the Predictability of Students' Grit by their Growth Mindset. *Participatory Educational Research (PER),* Vol.*10*(5), 184-199.

Yavuzer ,H.(2005). *Gençleri Anlamak.* Ankara:Remzi Kitabevi.

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.

Yeager, D. S., Hanselman, P., Walton, G. M., Murray, J. S., Crosnoe, R., Muller, C., Tipton, E., Schneider, B., Hulleman,C. S., Hinojosa, C. P., Paunesku, D., Romero, C., Flint, K., Roberts, A., Trott, J., Iachan, R., Buontempo, J., Yang, S. M., Carvalho, C. M., & Dweck, C. S. (2019). A national experiment reveals where a growth mindset improves achievement. *Nature*, *573*(7774), 364–369.

Yılmaz E., & Güven, Z.Z. (2022). Investigating Mindsets of University Student Candidates in terms of Some Variables, *Journal of Ahmet Keleşoğlu Education Faculty*, *4*(1), 75-94.

Yörükoğlu, A. (1998). *Gençlik çağı: Ruh sağlığı ve ruhsal sorunlar.* İstanbul: Özgür Yayıncılık

Zeng, G., Chen, X., Cheung, H. Y., & Peng, K. (2019). Teachers' growth mindset and work engagement in the Chinese educational context: Well-being and perseverance of effort as mediators. *Frontiers in Psychology*, *10*, 839.