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Exploring the Divide: Academic Pathways of Gifted High-Achievers and Underachievers in Magnet Schools

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Abstract

This study investigates the academic trajectories of gifted high-achievers (HA) and underachievers (UA) in South Korea's magnet high schools, offering insights into the psychosocial and parental factors influencing underachievement in East Asia. Using a longitudinal design, the study analyzed grade point averages (GPA) and self-reported measures of academic interest, intelligence beliefs, and parental involvement among 104 12th-grade students. Hierarchical cluster analysis identified two groups: HAs, who exhibited consistent academic growth, and UAs, who experienced significant GPA declines during high school. Early academic interest in mathematics and science emerged as the key differential factor, with HAs demonstrating stronger engagement during elementary school—a foundation that might have supported sustained success in more demanding academic settings. Contrary to expectations, both groups reported similar growth mindsets and levels of parental involvement, challenging conventional assumption about their influence on achievement within Confucian-heritage cultures. The findings highlight the importance of early academic interest as a predictor of long-term success and point to critical vulnerabilities during transitions to higher academic demands, particularly within the high-pressure environments of magnet schools. Implications include the need for targeted strategies to nurture early engagement, enhancing resilience, and developing culturally responsive strategies to mitigate underachievement among gifted students.

Introduction

Underachievement is a global concern that has been the focus of extensive research for over half a century (White et al., 2018; Baum et al., 1995; Dowdall & Colangelo, 1982; Farquhar & Payne, 1964; Matthews & McBee, 2007). Numerous studies have identified a range of individual, school, family, and cultural factors contributing to underachievement. However, much of the existing research has been conducted in multiracial Western countries, where systemic factors such as discrimination, economic disparities, and regional policy differences are often central to explanations of underachievement (Ford & Moore, 2013; Gomolla, 2006). These findings, while significant, may not apply to countries like South Korea, where education is centrally regulated by the national government, and over 96% of the population identifies as the same ethnicity. This homogeneity and centralized educational system necessitate the exploration of new drivers of underachievement beyond standard Western narratives. In Confucian-heritage cultures (e.g., China, Hong Kong, Taiwan, Japan, and South Korea), educational philosophies emphasize collectivist values, diligence, and perseverance, shaping achievement patterns differently than in Western Europe or United States (Stankov, 2010; Tan, 2017). Salili et al. (2001) observed that cultural emphasis on hard work and academic excellence in East Asian countries can, paradoxically, contribute to underachievement, particularly when combined with intense pressure

to excel. Examining gifted underachievement in these unique cultural and societal contexts is essential, as distinct educational norms, structures, and expectations may create unique trajectories for gifted students.

Despite systematic searches in academic databases (e.g., ERIC, PsycINFO, Google Scholar) using keywords related to "gifted underachievement" in Asia and East Asia, no empirical studies specifically addressing this issue have emerged. Furthermore, a review of official websites and government policy documents from various East Asian Ministries of Education revealed no publicly available data or formal reports explicitly addressing underachievement among gifted students. This gap is stark, especially considering the extensive research on high achievement in the region and the consistently high rankings of East Asian countries on international assessments like PISA and TIMSS (Deng & Gopinathan, 2016; Leung, 2002). This lack of region-specific data underscores an urgent need for empirical inquiry into the unique cultural, educational, and societal factors contributing to underachievement in Confucian-heritage contexts.

Significance of the Study

This study examines gifted underachievement within South Korea's magnet schools, exploring cultural and psychosocial factors beyond the Western-centric frameworks that dominate the literature. Factors such as academic interest, beliefs about intelligence (mindset), and parental involvement are frequently cited as influential in understanding gifted underachievement, with extensive research documenting their roles in European or U.S. schools (Dweck, 2013; Renninger & Hidi, 2011; Reis & McCoach, 2000). However, their influence and relationship to achievement may not be held uniformly in East Asia, where Confucian-heritage cultures emphasize diligence, perseverance, and collective success (Salili et al., 2001). This study seeks to refine understanding of these factors within the culturally distinct and academically demanding environment of South Korea's magnet schools. The findings contribute to theories of talent development and underachievement by highlighting potential divergences in the drivers of student performance across cultural landscapes. Implications include guiding school leaders in developing culturally sensitive screening and intervention protocols to identify at-risk students early and provide targeted support. Additionally, the results can inform policies on parental and community engagement, emphasizing the importance of maintaining a balance between high expectations and students' well-being to prevent burnout and loss of motivation over time.

Research Questions

RQ1: How do the academic trajectories of underachieving gifted students differ from those of high-achieving gifted students in a specialized STEM magnet school setting in South Korea?

RQ2: What role do psychosocial factors, such as interest in science, beliefs about intelligence, and parental involvement, play in differentiating underachieving gifted students from their high-achieving counterparts?

Literature Review

Giftedness

Understanding the concept of "gifted underachievement" begins with a clear definition of giftedness. While various conceptual models exist (e.g., Gagné's Differentiated Model of Giftedness and Talent, Renzulli's Three-Ring Conception), this study adopts the talent development megamodel (Subotnik et al., 2011, 2019) for its emphasis on the dynamic and

evolving nature of giftedness. Unlike static, trait-based frameworks, the talent development megamodel conceptualizes giftedness as a skill that emerges and develops over time, shaped by environmental support, motivation, and deliberate practice. This developmental perspective is particularly relevant for understanding how achievement evolves during the transitions from childhood to adolescence.

Drawing from general theories of development (e.g., Bronfenbrenner, 2005; Sameroff, 2010), the talent development megamodel identifies three phases of giftedness: potential, competence, and eminence. This study focuses on the first two phases. Potential, evident in childhood, represents broad abilities that may signal giftedness, while competence emerges during adolescence as individuals specialize and demonstrate mastery in domains such as science, mathematics, or athletics. The transition between these phases involves not only cognitive and technical skill development but also the acquisition of psychosocial attributes, including motivation, mindset, and self-regulation (Dweck, 2006). These factors are critical in determining whether early potential translates into sustained competence.

Gifted Achievers and Underachievers

When viewed through a developmental lens, gifted achievement and underachievement are dynamic, evolving phenomena. Understanding these divergent outcomes requires investigating the psychosocial and environmental factors that influence them. Traits such as resilience, motivation, and positive self-perception are often key facilitators of success (MacNamara et al., 2010). Conversely, low self-esteem, lack of motivation, and a fixed mindset can contribute to underachievement (Dweck, 2013; Wigfield & Eccles, 2000).

Environmental factors also play a significant role in shaping these outcomes. Gifted achievers often benefit from strong support systems—whether from parents, teachers, or peers—as well as access to enriching opportunities and tailored resources (Olszewski-Kubilius et al., 2014). In contrast, gifted underachievers may encounter insufficient support, inadequate challenges, or a mismatch between their abilities and the resources available, which can stifle their potential (McCoach & Siegle, 2003; Reis & McCoach, 2000). These psychosocial and environmental factors interact within a broader cultural ecosystem. For instance, cultural attitudes toward education and academic achievement significantly influence how students perceive their abilities and engage with learning. In cultures that place a high value on conventional academic success, such as those with Confucian-heritage values, gifted students may feel driven to excel academically. However, these same pressures can lead to burnout or disengagement if expectations become overwhelming or misaligned with a student's interests and well-being (Jiang et al., 2022).

The "forced-choice dilemma" (Gross, 1989) is particularly relevant in this context. Gifted adolescents may feel compelled to choose between achieving their academic potential and maintaining social acceptance. This tension can exacerbate stress, with cumulative effects that undermine academic performance and socioemotional development. Underachievers often find themselves trapped in a cycle of falling behind, compounded by low self-efficacy and diminished motivation. These affective challenges exacerbate their academic struggles, creating a downward spiral that becomes increasingly difficult to escape without targeted interventions. This issue is especially critical during high school–a pivotal period where gifted individuals are expected to transform their innate potential into tangible academic expertise. Achievement during adolescence serves as a barometer of how well an individual's potential has been cultivated since childhood and as a key predictor of future talent development into adulthood. Given the importance of this developmental stage, it is crucial to examine the factors that differentiate gifted achievers from

underachievers during high school. This study aims to identify mechanisms that support or hinder academic success in school-age gifted students. By understanding these factors, interventions can be designed to mitigate underachievement and support positive developmental trajectories for gifted learners.

Academic Interest

Academic interest serves as a key intrinsic motivator, significantly influencing gifted students' achievement by driving engagement, persistence, and deeper learning (Renninger & Hidi, 2011). Defined as a person-object relationship characterized by value, commitment, and positive emotional responses (Köller et al., 2001; Schiefele & Csikszentmihalyi, 1994), interest fosters meaningful processing of information and enhances both the depth of learning and achievement trajectories (Hidi et al., 2004). It also interacts with other factors, such as self-efficacy and mindset, to further shape academic performance (Dweck, 2006). For example, students who believe in their abilities and adopt a growth mindset are more likely to embrace challenges and persevere through difficulties. Conversely, a lack of interest often results in disengagement, superficial learning, and, ultimately, underachievement.

Cross-cultural research on gifted high school students highlights the importance of academic interest. Stevenson et al. (1993) found that high achievers in both East Asian countries and the United States frequently cited their desire for knowledge and personal growth as primary motivators for studying. In contrast, low achievers often attributed their efforts to external pressures, such as fulfilling parental or teacher expectations. While some students may initially excel due to external motivators, such as meeting expectations set by teachers or parents, this reliance often falters as academic demands intensify, particularly in competitive environments like magnet schools (Midgley et al., 2001). These settings, where stakes are high and the risk of failure looms large, tend to exacerbate the disengagement of students who lack a personal connection to the material (Wigfield & Eccles, 2000).

As students mature, their academic aspirations often align more closely with their personal interests and perceived abilities (Gottfredson, 1981). For instance, adolescents expressing an interest in pursuing a science-related career are three times more likely to graduate with a science degree than their peers without such interest (Tai et al., 2006). Conversely, students lacking genuine interest often avoid or fail to access critical opportunities for development (Buldu, 2006; Osborne & Collins, 2001). These findings underscore the pivotal role of academic interest in sustaining achievement among gifted students and preserving talent within the STEM pipeline.

Beliefs about Intelligence & Mindsets

Beliefs about intelligence play a critical role in shaping how students approach challenges, persist through difficulties, and achieve success. A fixed mindset, which views intelligence as a static trait, often leads students to avoid challenging tasks in order to protect their self-worth, thereby hindering engagement and academic growth (Dweck, 2006, 2013). Research indicates that gifted underachievers are more likely to hold fixed mindset beliefs, which increase their likelihood of underachievement (Mofield & Peters, 2019; Sisk et al., 2018). In contrast, a growth mindset—the belief that intelligence can develop through effort and perseverance—fosters resilience, motivation, and sustained interest in learning, even in the face of difficulties (Gonzalez-DeHass et al., 2024). This perspective enhances academic performance and supports ongoing engagement, creating a positive feedback loop that promotes both achievement and long-term learning.

Most research linking mindset and academic success has been conducted in Western countries, where this relationship is well-documented. However, evidence suggests that the strength and nature of this relationship may vary across cultures. For instance, studies have shown that East Asian students, regardless of achievement level, are more likely than their Western counterparts to hold beliefs aligned with a growth mindset (Heine & Hamamura, 2007; Stevenson et al., 1993). Scholars attribute this prevalence of growth mindset among East Asian students to the influence of Confucian heritage culture, which emphasizes effort as central to self-improvement, reinforcing the belief that success stems from hard work and perseverance (Hsin & Xie, 2014; Tweed & Lehman, 2002). Consequently, students raised in these cultures are more likely to adopt a growth mindset, as teachers and parents instill the idea that abilities can be cultivated through effort (Ng & Wei, 2020; Wang & Rao, 2019). The mediating effect of culture on the relationship between mindset and achievement underscores the importance of adopting a context-specific approach when studying these dynamics. This highlights the need for a nuanced understanding of how students engage with their unique cultural and educational environments.

Parental Involvement

Modern scholarship in gifted education emphasizes the interplay between personal attributes and environmental influences in talent development (e.g., Gagné, 2003; Renzulli & Reis, 2000; Subotnik et al., 2011). Among external factors, parental involvement plays a pivotal role in supporting gifted students. Involvement that encourages autonomy—such as fostering exploration and self-directed learning—has been linked to higher academic achievement and satisfaction (Gonzalez-DeHass et al., 2005). Lerner et al. (2022) found that students perceiving their parents as autonomy-supportive exhibit greater intrinsic motivation and persistence. Conversely, limited parental involvement is a common characteristic among underachieving gifted students. Reis and McCoach (2000) highlighted that inconsistent support or guidance often leads to isolation and diminished academic self-efficacy, exacerbating cycles of underachievement (Wang & Eccles, 2013). Beyond emotional support, financial investment in extracurricular resources, such as academic camps or private lessons, is critical for intellectual growth (Olszewski-Kubilius & Lee, 2004). Gifted underachievers often lack access to these opportunities, stunting their development and contributing to self-handicapping behaviors, such as disengaging from academic tasks to protect self-esteem.

Cultural and age differences significantly influence how parental involvement affects outcomes. Mau (1997) observed that parental engagement, such as volunteering, correlated with lower performance among Asian American students but benefitted White American students. In contrast, a meta-analysis by Kim (2020) found a positive correlation between parental involvement and academic achievement in East Asian secondary students ($r = .17$), stronger than in elementary students ($r = .05$). These findings challenge earlier research suggesting parental involvement declines in influence as children age (Pomerantz et al., 2007). The variability in findings underscores that parental involvement's impact may be culturally contingent. While generally beneficial, the effectiveness of parental involvement depends on its form and alignment with cultural norms and developmental stages. Understanding these nuances is crucial for tailoring interventions that leverage parental engagement to support gifted students effectively across diverse populations.

Current Study

Research on gifted underachievement has primarily focused on identifying ability-achievement discrepancies at single points in time (e.g., Landis & Reschly, 2013; Matthews & McBee, 2007; McCoach & Siegle, 2003). Most of this work has been conducted within Western educational models, often generalizing findings across subjects and neglecting the domain-specific nature of giftedness and talent development. However, the psychosocial and environmental factors that influence achievement can vary significantly depending on the subject area and cultural context. These variations give rise to distinct types of underachievers, each with unique behavioral patterns (Figg et al., 2012; Reis & McCoach, 2000). To address these complexities, it is crucial to move beyond a one-size-fits-all perspective and examine underachievement through the dual lenses of subject specificity and cultural norms. Expanding research to include non-Western contexts is especially critical, as cultural beliefs about ability, effort, and achievement profoundly shape educational outcomes. This study specifically emphasizes academic interest, mindset, and parental involvement due to their strong theoretical and empirical connections to gifted underachievement. These factors were selected because they represent key intersections between individual motivation and environmental support and align with well-established, actionable interventions. While we acknowledge that other measurable factors may also play a role, the focused exploration of these three variables ensures a clear and coherent framework for understanding gifted underachievement and developing targeted interventions.

Method

This retrospective study employs a longitudinal and culturally sensitive approach to explore the diversity of gifted students and their talent development over time. Students' grade point averages (GPA) were tracked alongside self-reported perceptions of individual factors (e.g., academic interest, beliefs about intelligence) and environmental influences (e.g., parental involvement) at multiple time points. The focus is on gifted South Korean students in STEM subjects, emphasizing the domain-specific nature of giftedness and talent development while accounting for the culturally specific factors that shape these trajectories. By examining why some students excel while others struggle under conditions widely deemed conducive to success, this research can shed light on underexplored dimensions of underachievement that differ from those commonly identified in contexts where inequitable access to high-quality education play a more central role.

Science High Schools and Participants

South Korea's 18 specialized science high schools, governed by the national Ministry of Education, offer an advanced, accelerated curriculum tailored to academically gifted students. Admission to these highly competitive magnet schools involves a rigorous three-step selection process, requiring candidates to rank in the top 2% citywide in science and mathematics, along with teacher recommendations and an oral examination (Seo, 2017). Teachers in these schools are licensed in gifted education, with many holding advanced degrees, including doctorates (Choi, 2013). Graduates of these schools frequently gain admission to prestigious universities both domestically and internationally.

This study, part of a national longitudinal research initiative by the Ministry of Education, focused on 104 12th-grade students randomly selected from the 18 science high schools. Participants were from two-parent, middle to upper-middle-class households and had benefited

from six years of gifted-focused curricula, specialized resources, and highly trained teachers. Unlike educational systems in countries with pronounced racial or socioeconomic disparities—where access to high-quality education varies significantly (Ford & Moore, 2013; Kotok, 2017)—all participants in this study had access to the same high-quality academic environment. This homogenized sample minimizes potential confounding effects of socioeconomic and family structure differences, allowing the study to focus on key factors such as interest in science, beliefs about intelligence, and parental involvement in shaping the academic trajectories of gifted achievers and underachievers.

Data Collection

Academic Achievement

Grade point averages (GPAs) were obtained from participants' school records across four key academic stages: early elementary school (average grades from 1st to 3rd grade), upper elementary school (4th to 6th grade), middle school (7th to 9th grade), and high school (10th to 12th grade). GPAs were calculated on a 7-point scale corresponding to letter grades (A to F), providing a standardized measure of academic performance at each level.

Self-report Instruments

Two surveys were used to evaluate students' perceptions of academic interest, beliefs about intelligence, and parental involvement. These surveys, originally developed in English, underwent a rigorous translation and validation process. Two bilingual research assistants translated the surveys into Korean, followed by back-translations into English by two additional bilingual assistants to ensure fidelity. Discrepancies between the back-translated and original versions were resolved through discussion among the translators, resulting in revised instruments. Pilot testing with South Korean high school students provided further feedback, leading to final adjustments for linguistic and conceptual equivalence. This process ensured the surveys were both valid and reliable within the South Korean cultural context.

Beliefs About Intelligence (BAI) Scale

The BAI Scale, adapted from Dweck et al. (1995), assessed whether participants viewed intelligence as an innate, unchangeable trait (fixed mindset) or as a malleable quality that could develop through effort (growth mindset). A Korean adaptation of the instrument (Cho & Han, 2004) preserved conceptual equivalence across languages. The scale included seven items, such as "No matter how much intelligence you have, you can always change it a good deal" and "I like work that I will learn from, even if I make a lot of mistakes." Responses were rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), with higher scores indicating a growth mindset. Reliability was strong, with Cronbach's α values ranging from .75 to .83. Model fit indices ($\chi^2(14) = 569.02$, $p < .001$; GFI = .872; RMR = .099) supported the validity of the instrument.

Inventory of Parental Influence (IPI)

The IPI, adapted from Campbell's (1994) Inventory of Parental Influence, included modifications to reflect the Korean cultural context (Cho & Han, 2004). Two new dimensions—

parents' communication and father's involvement—were added. The final 44-item instrument measured the following four dimensions:

- Support (5 items): Encouragement for autonomy and independent thinking (e.g., "My parents respect my decisions").
- Press for intellectual development (8 items): Promotion of intellectual growth through resources like books or trips (e.g., "My parents help me find books to read").
- Parents' communication (8 items): Frequency of educational discussions (e.g., "My parents talk about my grades and homework together").
- Father's involvement (8 items): Direct participation in learning (e.g., "My father helps me with homework").

Responses were rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), with higher scores indicating greater parental involvement. Reliability coefficients (Cronbach's $\alpha = .67$ to .89) and confirmatory factor analysis (GFI = .918 to .973) indicated the instrument's reliability and validity.

Academic Interest Questionnaire

The academic interest questionnaire measured students' evolving preferences and factors influencing their choices across different stages of education. Students reported their primary areas of interest (e.g., mathematics, science, language arts, social studies, music, art, sports) during lower elementary, upper elementary, middle school, and high school. Additionally, they identified the key influences shaping their interest in mathematics and science, including parents, relatives, friends, school, books, private institutes, and media.

Data Analysis

Jackson and Jung (2022) proposed that different methods for identifying gifted underachievers, such as IQ–achievement discrepancies and teacher nominations, can yield varying student subgroups. Given that our data lacked a standardized IQ measure and teacher nominations are inherently subjective, we adopted a modified version of Jackson and Jung's "simple difference" method, focusing on GPA changes across developmental stages to identify underachievement. While the original simple difference approach compares a student's performance to a fixed benchmark, our adaptation emphasizes relative GPA declines between key educational transitions, such as lower/upper elementary to middle/high school. This approach captures patterns of eroding achievement over time, which may be overlooked by IQ-based methods.

To enhance the precision of subgroup identification, we employed hierarchical cluster analysis, a widely used data-driven technique in educational research for categorizing individuals based on similar patterns in key variables (Borgen & Barnett, 1987; Lubke & Muthén, 2005). Using Ward's method with Euclidean distance, we minimized the within-cluster variance and identified the most parsimonious classification by examining the dendrogram. The resulting clusters were labeled as High Achievers (HA), characterized by consistently high GPAs, and Underachievers (UA), marked by significant GPA declines from elementary to high school. This person-oriented approach (Bergman & El-Khouri, 2001) aligns with the developmental framework of talent (Subotnik et al., 2011, 2019), ensuring the clusters meaningfully reflect performance changes over time.

To analyze group differences, we conducted independent samples t-tests to compare HA and UA groups across four GPA indicators: lower elementary, upper elementary, middle school, and high school. A repeated measures ANOVA with post-hoc analysis was used to evaluate GPA trends across the four educational stages for each group, while additional t-tests assessed GPA changes between successive transitions (e.g., lower to upper elementary, upper elementary to middle school, and middle school to high school). These analyses allowed us to identify statistically significant differences in academic performance patterns. Furthermore, a multivariate analysis of variance (MANOVA) was performed to explore differences in parental involvement and beliefs about intelligence between the achievement groups. Finally, chi-square analyses assessed changes in the proportion of students expressing interest in mathematics and science across educational stages, from elementary to high school. This comprehensive analytical approach enabled a robust examination of the factors influencing academic trajectories among gifted students.

Results

Achievement Groups

Hierarchical cluster analysis identified two distinct groups based on their academic performance trajectories from elementary through high school (see Table 1 below). Cluster 1, comprising 88 students, maintained consistently high GPAs across all academic stages. These students exhibited strong and stable academic performance, starting in lower elementary school and continuing through high school, characterizing them as High Achievers (HA). Cluster 2, consisting of 16 students, showed a pattern of declining GPAs. While these students performed well in earlier stages (lower and upper elementary school), their academic performance declined significantly during middle and high school, categorizing them as Underachievers (UA).

Table 1

Comparison of GPAs Between Gifted High-Achievers and Underachievers from Grade 1 to 12

School Level	High-Achievers (HA) (*N*=88)		Underachievers (UA) (*N*=16)		*t*	*Cohen's d*
	M	*SD*	*M*	*SD*		
Lower Elementary (grade 1-3)	5.85	1.17	6.21	1.00	-1.15	-.31
Upper Elementary (grade 4-6)	6.34	.75	6.54	.60	-1.00	-.27
Middle School (grade 7-9)	6.72	.40	6.54	.44	1.57	.43
High School (grade 10-12)	5.41	1.07	1.88	.80	12.58***	3.42

***p<.001

Differences in Achievement Patterns

Independent samples t-tests revealed no significant differences in GPA between the HA and UA groups during lower elementary through middle school. However, a significant difference emerged in high school GPAs, with the HA group significantly outperforming the UA group ($t(102) = 12.58$, $p < .001$) with a very large effect size (Cohen's $d = 3.42$).

Repeated measures analyses indicated significant changes in GPA for both groups (see Table 2). For the HA group, there was consistent GPA improvement from elementary through high school ($F(3, 261) = 50.23$, $p < .001$, partial $\eta 2 = .37$). In contrast, the UA group experienced GPA stagnation from elementary to middle school, followed by a sharp decline in high school ($F(3, 45) = 143.75$, $p < .001$, partial $\eta 2 = .91$).

Table 2

Repeated Measures of GPA Changes for Gifted High-Achievers and Underachievers

Transition Period	High-Achievers (HA) (*N*=88)			Underachievers (UA) (*N*=16)		
	MD	*SE*	*p*	*MD*	*SE*	*p*
Lower Elementary to Upper Elementary	.50	.09	<.001	.33	.19	.55
Upper Elementary to Middle School	.37	.07	<.001	.00	.15	1.00
Middle School to High School	1.31	.12	<.001	-4.67	.25	<.001

Independent samples t-tests further examined GPA changes during key educational transitions. No significant differences were observed between the two groups from lower to upper elementary years. However, significant group differences emerged during the transitions from upper elementary to middle school ($t(102) = 2.14$, $p = .035$, Cohen's $d = .58$), and from middle school to high school ($t(102) = 11.36$, $p < .001$, Cohen's $d = 3.09$), with greater declines in the UA group during these critical periods.

Belief About Intelligence and Parental Influences

No significant differences were found between the HA and UA groups in their beliefs about intelligence. Both groups scored within the growth mindset range on the Beliefs About Intelligence (BAI) Scale, subscribing to an incremental theory of intelligence. Similarly, the groups did not differ significantly in any of the four dimensions of parental involvement assessed (see Table 3).

Table 3

Comparison of Gifted High-Achievers and Underachievers in Their Beliefs about Intelligence and Parental Involvement

Measures	High-Achievers (HA) (*N*=88)		Underachievers (UA) (*N*=16)		*F*	*p*
	M	*SD*	*M*	*SD*		
Beliefs in Intelligence	3.88	.12	3.69	.22	.60	.44
Parental Support	3.91	.12	4.27	.24	1.75	.19
Press for Intellectual Development	4.02	.13	3.90	.25	.16	.69
Parents Communication	3.96	.14	4.05	.26	.09	.76
Father's Involvement	3.63	.15	3.54	.29	.06	.81

Achievement Groups and Academic Interest

A chi-square test revealed a significant difference between the HA (high achiever) and UA (underachiever) groups in the proportion of students who expressed interest in mathematics and science during elementary school (see Table 4). At the lower elementary level, 47.1% of HA students showed interest in math and science, compared to only 6.3% of UA students ($\chi 2=9.35$, df=1, $p < .01$). By upper elementary school, the percentage of students interested in these subjects increased to 59.8% for HA and 31.3% for UA, with the difference still statistically significant ($\chi 2=4.45$, df=1, $p < .05$). However, no significant difference was observed between the groups in the number of students reporting interest in math and science at the middle or high school levels.

Table 4

Comparison of Academic Interests in Gifted High-Achievers and Underachievers Across School Levels

School period	High-Achievers (HA) (*N*=88)		Underachievers (UA) (*N*=16)		χ^2
	N	*%*	*N*	*%*	
Lower Elementary	41	47.1	1	6.3	9.35**
Upper Elementary	52	59.8	5	31.3	4.45*
Middle School	68	79.1	12	75.0	.13
High School	78	90.7	12	80.0	1.51

*$p<.05$ **$p<.01$

Discussion

The phenomenon of gifted underachievement has been a persistent issue in educational research for nearly a century, as evidenced by numerous studies (e.g., Feger & Prado, 1986; Freeman, 2001; Gross, 2006; Ramos et al., 2023; Terman & Oden, 1947). This study adds to the literature by showing that underachievement is not merely a transient gap between potential and performance; rather, it manifests as a developmental trajectory that can be challenging to identify. Underachievement consists of a series of discrepancies between expected and actual performance, with these gaps often widening when the underlying causes go unrecognized or unaddressed. Prominent differences in performance became discernible when the gifted students in this study enrolled in magnet schools, where academic demands are substantially higher and the competitive environment more intense than in their previous general education experiences. The decline in the gifted underachievers' academic performance during high school may reflect the Big-Fish-Little-Pond Effect (BFLPE), which posits that equally capable students may experience lower academic self-efficacy in higher-achieving or selective settings compared to less competitive environments, primarily due to social comparisons based on local norms (Dai & Rinn, 2008; Marsh et al., 2004). These dynamics likely contribute to the observed decline performance measures among gifted underachievers.

The findings from this study lend credence to the hypothesis, revealing significant differences between high-achieving (HA) and underachieving (UA) students, particularly during the transition from middle school to high school. Although both groups exhibited similar performance levels in earlier years, UA students experienced a marked decline in GPA during high school, highlighting a period of vulnerability where the challenges of more advanced coursework and increased

academic pressure may overwhelm students lacking intrinsic motivation or engagement. These results align with the academic patterns identified in prior research, such as the achievement trajectories discovered by Cho et al. (2008) in their study of South Korean high school students. They identified four groups, each with their own individual achievement pattern. Full-bloomers are students who maintained consistently high GPAs from elementary through high school. Good-achievers have strong grades, but not as exceptional as full bloomers. Fade-aways are students who started with high school performance in their early years, and then began a steady decline thereafter. Lastly there are the late-bloomers, whose academic performance gradually improved from mediocre grades in elementary school to exceptional performance in high school. The HA and UA groups identified in our study closely resemble the "full-bloomers" and "fade-aways," respectively, in their academic trajectory patterns.

The pivot point between the two groups coincides with the transition from general education middle school to selective high school. Prior to entering the elite magnet schools, these gifted students may have experienced a "big fish in a small pond" effect, benefiting from a relative advantage in their general education settings. However, upon transitioning to specialized science high schools, they encounter a more competitive academic environment, with increased academic pressures and more complex coursework. This shift may challenge their self-perceptions and coping mechanisms, particularly for those at risk of underachievement. While the "big fish in a small pond" effect provides a plausible explanation, it is important to note that this phenomenon has not been directly measured in the present study. However, prior research in both Western (Marsh & Hau, 2003; Zeidner & Schleyer, 1999) and Asian contexts (Seaton et al., 2009; Sung et al., 2014) supports the potential adverse impact of heightened competition within high-ability schools. Our findings suggest that social comparison and self-perception likely play interdependent roles in influencing underachievement.

Furthermore, our findings underscore the need to monitor not only static achievement indicators like GPA but also the progression of academic performance as students transition through various educational levels. While the underachievers in this study exhibited academic performance similar to the high achievers during elementary and middle school—sometimes even outperforming them, though insignificantly—what distinguished the two groups was the pattern of improvement. High achievers demonstrated consistent academic growth over time, while underachievers stagnated, particularly during key transitions between school levels. These findings suggest that sustained improvement, rather than high performance at isolated points in time, may be a more reliable predictor of long-term academic success.

Academic Interest and Its Role in Achievement

One of the key distinctions between the HA and UA groups was their early interest in mathematics and science. The significant differences in reported interest during elementary school suggest that early academic curiosity plays a pivotal role in shaping long-term success. As previous research has demonstrated, academic interest serves as an intrinsic motivator that drives deeper engagement with subject matter, encourages persistence in the face of challenges, and ultimately supports higher achievement (Krapp, 2002; Renninger & Hidi, 2020). The finding that UA students did not report significant interest in these subjects during elementary school may indicate that a lack of early engagement could have contributed to their later struggles with more difficult coursework.

Early interests shape the types of experiences to which individuals expose themselves, and the earlier a person becomes interested in subjects such as mathematics or science, the sooner they

begin to seek out and engage in enriching experiences within those domains. This early engagement allows for more opportunities to practice and refine their skills, compete with others, and learn to manage setbacks, all of which contribute to the development of traits that support achievement (Joyce & Farenga, 1999). These selected experiences foster personality attributes like perseverance, curiosity, and resilience, which are crucial for success in high-stakes, intellectually demanding fields such as STEM. This cumulative effect has been widely observed in scientific fields and has been linked to the success of high-performing students and even Nobel laureates (Golden, 2018). The continuous accumulation of small advantages—such as early exposure, consistent practice, and repeated successes—enables individuals to sustain high levels of achievement. This phenomenon helps explain why students classified as "Full-bloomers" in this study were able to maintain their academic success in competitive environments, while those categorized as "Fade-aways," who developed an interest in math and science later, struggled to keep up. Early interest in a domain can thus act as a catalyst, providing individuals with the tools they need to thrive in rigorous academic settings.

However, the fact that no significant differences were observed between the groups in middle or high school suggests that interest may not be a sufficient predictor of success once students have progressed to more advanced levels. This aligns with research indicating that while early interest is important for laying the foundation for academic success, other factors, such as perseverance, resilience, and coping strategies, become increasingly critical as academic demands grow. The diminished role of academic interest in later stages could also reflect the intense pressure within South Korean academic culture, where external motivators, such as societal expectations and parental pressure, may temporarily overshadow intrinsic curiosity.

Beliefs about Intelligence and Underachievement

Interestingly, there was no significant difference between the HA and UA groups in their beliefs about intelligence, with both groups reporting growth mindset tendencies. This challenges the notion that mindset alone is a strong predictor of academic success in this context (Zhao, 2020). This study's findings suggests that the relationship between mindset and achievement may be more nuanced in highly competitive, high-pressure environments like South Korean magnet high schools. Studies have shown that students in Confucian-heritage societies tend to place a strong emphasis on effort rather than innate ability, which aligns with the incremental theory of intelligence (Li & Bates, 2019; Tweed & Lehman, 2002). In this cultural framework, even students who are struggling academically may still hold the belief that persistent hard work can lead to improvement. This belief is reinforced by parents, teachers, and societal expectations, where success is viewed as a product of diligence and effort (Bernando, 2008; Fwu et al., 2017). Given this cultural ethos, the absence of a significant difference between the HA and UA groups in their beliefs about intelligence could be attributed to the societal emphasis on hard work, which pervades both groups. In environments where external pressure and competitiveness are high, other factors, such as academic interest and the ability to manage stress, may take on a more prominent role in determining academic outcomes.

The Role of Parental Involvement

The absence of significant differences in parental involvement between the HA and UA groups in this study aligns with findings from prior research about parental influences in Asian and Asian American societies (Ng & Wei, 2020; Watkins & Butler, 2017). In Confucian-heritage cultures, high levels of parental involvement are typical across different academic performance levels,

driven by deeply ingrained cultural values that stress the importance of education, hard work, and filial duty. As fertility rates in Korea have declined, many parents have concentrated their efforts and resources on fewer children, further intensifying their involvement (Shin et al., 2019). This is compounded by the hyper-competitive Korean educational system, where anxious parents strive to provide their children with every possible advantage to mitigate future risks and challenges (Lee & Shouse, 2011). Moreover, the sample in this study consisted of students from middle to high-middle-class income households with two parents. This homogeneity in household structure and socioeconomic status likely minimized variations in parenting styles or financial investment, making it challenging to detect subtle differences in parental involvement between achievers and underachievers.

Contextualizing Gifted Underachievement

This study highlights the distinct context of South Korean magnet schools, contrasting sharply with the multiracial and multicultural systems of Western countries, where much of the existing research on gifted underachievement has been conducted. In Western settings, societal values emphasize individuality and diversity, resulting in a wide variation in mindsets and parental involvement. These factors often serve as distinct constructs differentiating high-achieving (HA) and underachieving (UA) students. For example, HA students are more likely to exhibit a growth mindset, fostering resilience and sustained effort, while benefiting from parental involvement characterized by emotional support and academic guidance (Dweck, 2006; Reis & McCoach, 2000). Conversely, UA students in the West are often associated with fixed mindsets and lower levels of parental engagement, contributing to disengagement and academic struggles (Mofield & Peters, 2019).

In South Korea, the cultural and racial homogeneity of the population, particularly within this study's sample of students from two-parent households attending similar elite schools, presents a markedly different macrocosm. In this context, mindset and parental involvement are not easily separable from the collective cultural framework, as they are inherently shaped by societal norms that emphasize effort, diligence, and collective success (Li & Bates, 2019; Tweed & Lehman, 2002). This finding challenges the applicability of Western-centric models of underachievement, which often treat mindset and parental involvement as independent constructs. However, in Confucian-heritage cultures like South Korea, these factors are subsumed within the cultural ethos that shapes students' educational experiences as part of a collective, making it difficult to assess their independent contributions to academic outcomes.

However, this does not preclude the presence of nuanced effects that this study was not able to fully explore. For instance, while parental involvement is consistently high across the sample, its nature may differ in ways that influence outcomes. Some forms of parental involvement may amplify pressure, reducing autonomy and posing challenges for students who lack coping mechanisms to manage stress effectively (Shin et al., 2019). Similarly, while both HA and UA students share a belief in the importance of effort, UA students may struggle to translate this belief into sustained performance when confronted with intense academic demands and social comparisons in magnet school settings (Marsh & Hau, 2003; Zeidner & Schleyer, 1999).

The insights from this study underscore the importance of cultural and systemic context in understanding gifted underachievement. In Western-focused models, interventions often focus on fostering a growth mindset and increasing parental engagement as pathways to improve student outcomes. However, in East Asian settings like South Korean magnet schools, where these factors are relatively uniform, interventions may need to address other dynamics, such as helping students

manage academic stress, navigate competitive environments, and develop intrinsic motivation. By highlighting these contextual differences, this study contributes to a more nuanced understanding of gifted underachievement, demonstrating the need for culturally and contextually tailored approaches to support high-ability learners.

Implications and Future Directions

The findings of this study demonstrate that early interest in science is a strong predictor of later academic success in high school science, supporting Joyce and Farenga's (1999) assertion that students' perceptions of and enthusiasm for science are shaped long before they encounter formal science education. Early exposure fosters positive attitudes toward science (Bruce et al., 1997), enhances conceptual understanding, and familiarizes children with the language and thinking patterns of scientific inquiry long before formal education begins. Young children are not only capable of engaging with scientific reasoning but also stand to gain significantly from early involvement in scientific learning. Rather than attributing underachievement to insufficient cognitive readiness for science concepts, educators and policymakers should prioritize creating opportunities that spark enduring scientific interest. Schools should incorporate hands-on, inquiry-based learning experiences into early childhood and elementary education, such as age-appropriate experiments, nature exploration, and interactive STEM challenges. Extracurricular programs, including after-school clubs, robotics competitions, and mentorships with STEM professionals, offer further opportunities for exploration, with role models inspiring students to envision futures in STEM careers. Families and community organizations can also play a critical role in cultivating early interest in science. Activities like museum visits, science fairs, and at-home experiments can reinforce enthusiasm and build connections to STEM. Policymakers should prioritize funding for early STEM education initiatives that promote curiosity and engagement from a young age. This includes supporting teacher training in inquiry-based science instruction, providing resources for hands-on activities, and incentivizing schools to develop co-curricular programs like science fairs and research opportunities. Future studies should examine which specific experiences (e.g., frequent lab activities, museum trips, role models in STEM) are more effective in instill a deep-seated interest that can withstand the challenges of advanced coursework later on.

The absence of significant differences in mindset and parental involvement between high achievers (HA) and underachievers (UA) raises important questions about the specific mechanisms that contribute to underachievement in high-pressure academic environments. The findings point to other factors, such as self-regulation and resilience, that can become increasingly crucial as students advance through higher levels of education. Additionally, cultural norms of deference to authority and collective honor may mask subtle variations in mindset among top-performing students. Interventions should therefore focus on identifying and addressing these hidden variations, as well as promoting agency and creativity alongside traditional values of effort and perseverance. Given the high-pressure academic environment, teachers should also integrate stress management techniques and provide opportunities for independent exploration to help students develop resilience and sustain interest in STEM over time.

Future research should explore how academic interest interacts with factors—school climate, teacher expectations, or peer-group influences in Confucian-heritage cultures. Finally, this study's culturally bound insights highlight the importance of contrasting underachievement drivers in East Asia with those in Western nations. Comparative research is needed to determine whether early interest in science holds similar importance in Western contexts or whether other factors, such as teacher expectations or systemic inequities, take precedence. While underachievement is a global

phenomenon, its underlying causes are far from uniform. By mapping the interplay of personal interest and systemic factors in various cultural environments, we can move toward a more global understanding of how and why talented students sometimes fail to reach their full potential.

Limitations of the Study

This study presents valuable findings regarding the academic trajectories of gifted achievers and underachievers; however, several limitations must be acknowledged. First, the homogeneity of the sample may limit the generalizability of the results. All participants were from middle to high-middle-class households with two-parent families, potentially reducing the variability in parenting styles and socioeconomic factors. Also, the sample size of the study may reduce the statistical power of the analyses, increasing the risk of Type II errors. Additionally, the small UA group size (N =16) may limit the generalizability of the findings to all underachieving gifted students, as the characteristics of this subgroup may not fully represent the broader population of gifted underachievers. Second, while the magnet schools in South Korea are widely regarded as competitive (Lee & Kim, 2012), the intensity of pressure was not directly measured. Likewise, references to a potential "big-fish-little-pond effect" (Marsh & Hau, 2003) are based on the hypothesis that some underachievers may experience negative social comparisons in a high-achieving context. Future research should employ validated stress or self-concept inventories to confirm these contextual assumptions empirically. Thirdly, the study relied on self-reported data, particularly for perceptions of parental involvement, academic interest, and beliefs about intelligence. Self-report measures can be subject to biases, such as social desirability bias, where students might respond in ways they perceive as socially acceptable rather than reflecting their true feelings. This limitation may affect the accuracy of the data collected regarding psychosocial and environmental factors. Lastly, this study focuses specifically on academic interest, mindset, and parental involvement as key factors influencing gifted underachievement. While these variables were chosen for their strong theoretical and empirical connections to gifted underachievement and their actionable potential in interventions, this focused approach inherently excludes other measurable factors (e.g., peer relationships, teacher-student dynamics, school climate) that may also play significant roles. Since this study utilizes secondary data from the South Korean Ministry of Education dataset, our analysis is inherently limited to the variables captured during the original data collection process. By recognizing these limitations, future research can address these gaps to further investigate the complex interplay of factors that influence gifted students' achievement trajectories across diverse contexts.

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