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Growth mindset and achievement goal orientation in high-achieving students

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ABSTRACT
The conviction that individuals hold about their own intelligence can significantly affect their motivation and learning outcomes. This study aims to investigate students' growth mindset and personal achievement goal orientation. Data were collected from 10th-grade students, totalling 644 (233 males and 411 females), from 19 schools in the lower northern region of Thailand participating in the Science, Mathematics, Technology, and Environment (SMTE) Programme. Two research instruments adapted for Thai use were utilized: the Growth Mindset Scale and the Personal Achievement Goal Orientation Scale. There was no statistically significant difference in the growth and fixed mindset between boys and girls. The path analysis from growth mindset to mastery goal, performance-approach goal, and performance-avoidance goal were significant. Meanwhile, the analysis from fixed mindset to mastery goal, performance-approach, and performance-avoidance goal were also significant. To predict grade point average (GPA), representing academic achievement, only the regression from mastery goal to GPA was significant. This indicated that mastery goals act as a mediator between growth mindset and GPA. The findings provide insights regarding the relationship between growth mindset and academic achievement, highlighting personal learning goals as a mediator.

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Introduction

Recent research highlights the crucial role of a growth mindset, where individuals believe they can improve their abilities over time and are willing to put in effort, as a key factor in supporting academic achievement across different contexts. For instance, Bai & Wang (2023) highlighted the impact of growth mindset on self-regulated learning strategies, such as monitoring and effort regulation, which contributed to language learning success in primary school students. Similarly, Fathi et al. (2024) found that growth mindset, coupled with self-efficacy, significantly enhanced language achievement through its influence on grit. Combette et al. (2024) further confirmed that growth mindset correlated with the adoption of mastery goals, which prioritised learning and personal improvement, even in adult populations. While growth mindset interventions have shown promise in enhancing children and adolescents' attitudes, motivation, and academic persistence, their direct effects on academic performance remain inconclusive. For instance, a meta-analysis by Burnette et al. (2013) noted that

growth mindset was associated with enhanced self-regulatory processes, such as achievement goal orientation, especially under ego-threatening conditions (e.g., A student asked to solve a difficult math problem on the board, knowing that failure might lead to embarrassment or judgment). Similarly, Wang et al. (2021) reported modest improvements in academic performance through growth mindset interventions in chemistry contexts but noted variability in effectiveness depending on the intervention design and implementation. Conversely, large-scale reviews and meta-analyses suggested that growth mindset interventions often yielded small or negligible effects on academic outcomes, with methodological issues and publication bias complicating the interpretation of results (Li & Bates, 2020; Macnamara & Burgoyne, 2023). The relationship between growth mindset and academic achievement is not straightforward. Some studies show no significant correlation, suggesting that the role of mindset may vary as a cause, mediator, or outcome of achievement (Stohlmann, 2022; Zhang et al., 2017). One of the variables associated with academic achievement and linked to growth mindset is achievement goal. Growth and fixed mindsets are closely connected to the types of achievement goals individuals pursue, whether students aim to improve competence (mastery goals) or to demonstrate competence compared to others (performance goals), especially in academic settings. (Blackwell et al., 2007; Cook et al.,2017; Robin & Pals, 2002).

The enrichment programme of Science, Mathematics, Technology and Environment (SMTE) in Thailand provides an ideal context for exploring the interaction between growth mindset, achievement goal orientation, and academic achievement. This programme has been developed through collaboration among major educational and scientific organisations in Thailand, including The Institute for the Promotion of Teaching Science and Technology (IPST), Office of the Basic Education Commission (OBEC), Office of the Higher Education Commission (OHEC), and National Science and Technology Development Agency (NSTDA). The programme aims to support and nurture high-ability students, in grades 10–12, in science and technology. Students eligible to enrol in this programme must have demonstrated strong academic performance at the lower secondary level and passed a national standardised entrance-to-the-programme examination. This exam assesses knowledge and skills in science, mathematics, and technology. The programme has been in operation since 2007, including 220 schools, and has been taught for the upper secondary levels in separate schools. It is managed through a network structure consisting of 9 networks, which are divided based on the country's geographical regions. This study collected data from the lower northern region network.

The participating schools provide a specialised curriculum emphasising advanced content knowledge in science and mathematics skills. The curriculum includes special activities such as science camps, study trips, research internships, and opportunities for students to conduct advanced STEM projects. The characteristics of such a programme align with research on gifted learners, which suggests implementing differentiated curricula that include challenging and meaningful content to engage their advanced abilities (Gül & Ayık, 2024; Ulger & Çepni, 2020). However, such challenges demand resilience, self-efficacy and adaptive learning strategies—attributes strongly linked to growth mindset (Bandura, 1999, 2023; Dweck & Leggett, 1988; Pintrich, 2000). SMTE students face unique challenges, including high expectations and competitive environments, which necessitate an understanding of how growth mindset and achievement goals interact to influence their academic success. Yang & Gentry (2023) found that underrepresented students (Black, Hispanic, Native American) in STEM fields often face pressures such as impostor syndrome and a "chilly" environment, which can negatively affect their motivation and learning outcomes. Gender differences in mindset and achievement goals further complicate these dynamics. Some studies have found gender differences in specific subjects such as mathematics (Bostwick et al., 2020; Degol et al., 2018; Wang et al., 2021), mathematics and ICT (Sáinz & Eccles, 2012), physics (Kalender et al., 2022; Malespina et al., 2022; Marshman et al., 2018), and STEM (Eccles, 2011). These research findings demonstrated that females exhibited lower levels of mindset and self-concept compared to males, which could influence their future career choices or decisions to pursue higher education.

Despite its importance, research on growth mindset and achievement goal orientation in Thailand remains limited, particularly for high-ability learners in specialised programmes such as

SMTE. Most studies of the individuals' implicit theories were explored within a Western context. In Asian contexts, however, these theories may hold different implications due to diverse cultural values, such as collectivism and the utility of education (Hau & Salili, 1996). For example, in Hong Kong, Chen & Wong (2014) observed that the motivations of Chinese students, influenced by cultural factors such as educational emphasis and competition, differ from Western norms. Specifically, they found a positive association between performance-approach goals and academic achievement but a negative impact from performance-avoidance goals. Similarly, in the Philippines, research found that the growth mindset intervention could improve learners' creativity, habits of mind, and mathematics performance from the "low" to "average" level (Almeria, 2023). In Thailand, efforts have been made to adapt psychological research tools to the local context (Poondej, 2016) and explore the link between lifestyle values and achievement goal orientation (Chantara et al., 2014). Although there have been attempts to investigate implicit theories, specifically in Thailand, the results are still incomplete. Important factors, including the emphasis on students enrolled in specialized science programs and the connections between growth mindsets, achievement goal orientation, and academic success, have not been thoroughly examined. Therefore, this current study aims to explore the relationship between academic achievement, growth mindset, and achievement goal orientation, particularly in the context of Thailand.

Research Questions

1. Do male and female students in the SMTE classroom exhibit different growth and fixed mindsets (RQ1)?
2. What kinds of achievement goal orientation do students in the SMTE classroom exhibit?
3. What is the relationship between academic achievement, growth mindset, and achievement goal orientation among SMTE students (RQ3)?

Literature Review

Implicit Theory

Implicit theories are beliefs about whether personal intelligence is fixed or malleable (Dweck et al., 1995). Research since the 1980s has demonstrated that beliefs, thoughts, and feelings about one's potential significantly influence how learners succeed, fail, or respond to failure (e.g., Dweck & Leggett, 1988; Elliott & Dweck, 1988). Based on the individuals' implicit theories, young people with a 'fixed mindset' tend to believe that their intelligence is limited and inherent and incapable of significant development. Children with a 'growth mindset', on the other hand, believe that their intelligence can be developed through hard work, effective learning strategies, guidance from others, or even persistence in the face of setbacks (Blackwell et al., 2007; Dweck & Leggett, 1988; Haimovitz & Dweck, 2017; Yeager & Dweck, 2012). The implications of the implicit theory influence motivation, learning strategies, judgment of self and others, and responses to failure (Dweck et al. 1995). Moreover, the growth mindset has been associated with positive outcomes, including improved mental health and reduced stress. (Ku & Stager, 2022; Yeager & Dweck, 2012; Zeng et al., 2016). Evidence from Xu et al. (2021) indicated that cultivating a growth mindset could reduce cognitive load and enhance learning retention. These findings suggest that its benefits might be more visible in process-oriented outcomes rather than grades and highlight the need for more nuanced research to understand the conditions under which growth mindset promotes academic achievement.

Achievement Goal Orientation Theory

Dweck & Leggett (1988) linked implicit theories to achievement goal orientations, showing that entity theorists tend to adopt performance goals focused on proving ability, whereas incremental

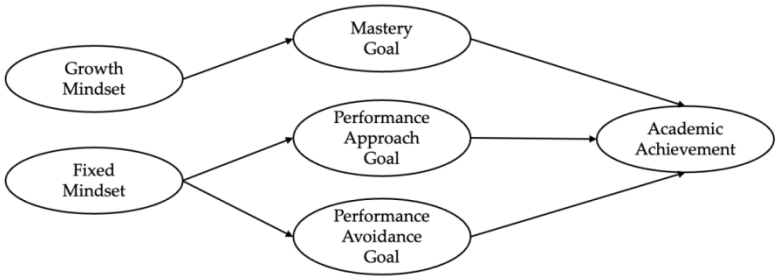
theorists pursue learning goals aimed at growth. These orientations influence how individuals respond to challenges—learning goals promote resilience, while performance goals can lead to helplessness. The achievement goals typically fall into two main categories: mastery and performance (Combette et al., 2024). Mastery goals emphasise the intrinsic desire to gain competence and understanding in tasks, fostering deep engagement and adaptive learning strategies. In contrast, performance goals focus on demonstrating competence compared to others. These include striving for recognition or avoiding negative evaluations (Elliot & Church, 1997; Theis et al., 2020). In achievement motivation research, Elliot & Church (1997) proposed a trichotomous framework that includes mastery, performance-approach, and performance-avoidance goals. Mastery goals, focused on developing competence and task mastery, are characterized by a pure approach orientation, grounded in achievement motivation and high competence expectancies, and are associated with intrinsic motivation. In contrast, performance goals, centred on external evaluations, are bifurcated into approach and avoidance components: performance-approach goals aim at obtaining favourable judgments of competence, while performance-avoidance goals focus on avoiding unfavourable judgments. This partitioning reflects the distinct regulatory processes involved, as performance goals naturally lend themselves to both positive (approach) and negative (avoidance) motivations, whereas mastery goals do not exhibit this dual structure (Elliot & Church, 1997). Mastery goals are often associated with better academic outcomes, as they promote deep learning and intrinsic motivation (Alhadabi & Karpinski, 2020). Learners pursuing mastery goals tend to engage in self-regulated learning strategies, such as goal setting and monitoring, which directly contribute to academic achievement (Bai & Wang, 2023). In contrast, performance goals can have mixed outcomes; performance-approach goals may lead to high achievement when the focus is on outperforming peers, but performance-avoidance goals are generally linked to maladaptive behaviours and lower achievement (Hulleman et al., 2010; Yeager & Dweck, 2020). Furthermore, the adoption of mastery goals mediates the relationship between growth mindset and academic success, emphasising the role of goal orientation as a conduit for mindset effects on learning achievement (Blackwell et al., 2007).

Conceptual Framework

Based on previous studies on the relationships between growth mindset, achievement goal orientation, and academic achievement, a conceptual framework has been developed for this study. In this framework, mastery goals are associated with a growth mindset and serve as a mediator, enabling the positive effects of a growth mindset on academic achievement, such as GPA (Blackwell et al., 2007; Combette et al., 2024). In contrast, performance-approach goal and performance avoidance goal are linked to a fixed mindset, which has a negative impact on academic achievement (Yeager & Dweck, 2020). Figure 1 illustrates the conceptual framework.

Figure 1

Conceptual framework of the study



Methods

This study is survey research that collected data in July 2023. It was conducted as part of an orientation activity for 10th-grade students of the SMTE programme from 19 schools across eight provinces in the lower northern region of Thailand. The data were collected online, with students willingly responding to the questionnaires. Parental consent was obtained for student participation, and the study requires participants to provide personal information, such as their grade point average. Some students may feel uncomfortable disclosing this to others; therefore, all data collected remained anonymous to ensure the students' privacy.

Participants

The participants consist of 10th-grade students studying in the academic year 2023, totalling 644 individuals, including 233 males and 411 females, with an average age of 15-16 years. This group of students has been selected to continue their upper secondary education in the enrichment programme for Science, Mathematics, Technology, and Environment (SMTE). They are eligible to enrol in this programme because they have demonstrated strong academic performance at the lower secondary level (GPA) and passed a national standardised entrance examination.

Data Collection

The survey was part of the orientation activities for students selected for the SMTE program. These activities have three main objectives: to clarify the programme's goals, to inspire students through lectures by well-known scientists in the country, and to explore students' learning goals and background information for further analysis. This study utilises data collected from the third objective of these orientation activities.

The survey process allowed students to provide information by clicking "agree" before answering online questions. Students may choose to respond with 'agree' or 'disagree,' with no impact on their participation in the orientation activities. The survey questions consisted of two main sections: 1) *Demographic Information* inquired about gender, categorised into two options (male coded as 1, female coded as 2), and GPA, the average score in the six semesters of middle school, 2) *Growth & Fixed Mindset* and *Personal Achievement Goal Orientation*. The following section delves deeper into the latter portion of the survey, which serves as the main research instrument.

Research Instrument

The research instruments were as follows: 1) the Growth Mindset Scale (Dweck, 1999) is a 5-point Likert scale comprising 8 questions. Four questions assess the growth mindset (4 items), while the remaining four questions assess the fixed mindset (4 items) 2) the Personal Achievement Goal Orientation Scale, which is one of the dimensions of Patterns of Adaptive Learning Scales (PALS) (Midgley et al., 2000). This study adopted the Personal Achievement Goal Orientation Scale in a 5-point Likert scale consisting of 9 questions that assess aspects of students' perceptions of the classroom environments, which include learning goal orientation (3 items), performance approach (3 items), and performance-avoidance goals (3 items). Both instruments were Thai version. The first author translated all instruments from English to Thai and then verified the translation by face validity with one English language expert. The Thai draft version was revised in some wording to be more appropriate for students. All items were combined into a single survey, resulting in a total of 17 items across 5 dimensions.

According to the *Standards for Educational and Psychological Testing*, one method to verify instrument validity is to conduct a Confirmatory Factor Analysis (CFA). The CFA facilitates the

assessment of construct validity by examining whether the theoretically defined structure adequately explains the relationships between latent variables and observed indicators. Additionally, it evaluates model fit using indices such as CFI, TLI, and RMSEA (American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 2014). In addition, the H coefficient, calculated using factor loadings and error variances from structural models like CFA, directly reflects the relationship between observed and latent variables, making it more suitable for evaluating theoretical constructs than Cronbach's alpha. It offers greater precision, flexibility, and the ability to account for error correlations, providing a more accurate assessment of reliability in latent variable research (Komperda et al., 2018). The results of the validity and reliability analysis of the instrument will be presented next in the research findings section.

Data Analysis

The validity of the internal structure was assessed through confirmatory factor analysis (CFA) to evaluate the extent to which the data aligned with the hypothesized domain structure, including growth mindset, fixed mindset, mastery goal, performance-approach goal, and performance-avoidance goal. The criteria from Hu & Bentler (1999) were used to assess the model's fit. The reliability of each factor in confirmatory factor analysis (CFA) is most effectively assessed using Coefficient H, which calculates the variance accounted for by a factor based on standardized regression loadings (Hancock & Mueller, 2001).

To answer RQ1 and RQ2, the analysis involved computing means, standard deviations, and independent *t*-tests. For RQ3, Pearson's correlation and structural equation modelling (SEM) were employed to explore the structural relationships among growth mindset, fixed mindset, mastery goals, performance-approach goals, and performance-avoidance goals. All analyses were conducted with jamovi 2.3.28, utilizing packages from R.

Results and Discussion

Validity and Reliability of the Measure

The CFA result indicated that the model had poor to marginal fit (CFI = 0.86; Gamma hat = 0.93; RMSEA = 0.079 (90%CI = 0.072 - 0.086); SRMR = 0.062). This provided adequate evidence to indicate that revising the questionnaire could yield an acceptable outcome. One item from the growth mindset domain was removed due to having a negative standard estimate. Subsequently, upon reanalysis, it was found that the model had a good fit (CFI = 0.91; Gamma hat = 0.95; RMSEA = 0.067 (90%CI = 0.059 - 0.074); SRMR = 0.047). Table 1 provides items, factors, standardised loadings, and coefficient H for this model.

Table 1

Items, factors, standardized loadings, and coefficient H

Factor/Item	Loading
Fixed Mindset (Coefficient H = 0.76)	
F1 You have a certain amount of intelligence and can't really do much to change it.	0.580
F2 Your intelligence is something about you that you can't change very much.	0.720
F3 To be honest, you can't really change how intelligent you are.	0.671
F4 You can learn new things, but you can't really change your basic intelligence	0.661
Growth Mindset (Coefficient H = 0.71)	
G1 No matter who you are, you can significantly change your intelligence level.	0.724

G2 You can always substantially change how intelligent you are.	0.510
G3 You can change even your basic intelligence level considerably.	0.713
Mastery goal orientation (Coefficient H = 0.73)	
M1 It's important to me that I learn a lot of new concepts this year.	0.702
M2 It's important to me that I thoroughly understand my class work.	0.593
M3 It's important to me that I improve my skills this year.	0.746
Performance approach goal orientation (Coefficient H = 0.73)	
P1 It's important to me that other students in my class think I am good at my class work.	0.643
P2 One of my goals is to show others that classwork is easy for me.	0.760
P3 One of my goals is to look smart in comparison to the other students in my class.	0.631
Performance avoidance goal orientation (Coefficient H= 0.77)	
PA1 It's important to me that I don't look stupid in class.	0.773
PA2 It's important to me that my teacher doesn't think that I know less than others in class.	0.790
PA3 One of my goals in class is to avoid looking like I have trouble doing the work.	0.453

The results of the CFA analysis and coefficient H provide evidence supporting that the validity and reliability of the measurement are acceptable, allowing for further data analysis to address the research questions.

RQ1 : Do Male and Female Students in the SMTE Program Have Different Growth Mindsets?

The results of the analysis are illustrated in Table 2. The analysis results revealed that among the SMTE classroom students who responded to the questionnaire, male students (N=233) had an average growth mindset score of 3.94 (M 3.94, SD 0.725), an average fixed mindset score of 2.41 (M 2.41, SD 0.900) while female students (N=411) had an average growth mindset score of 3.86 (M 3.86, SD 0.728), an average fixed mindset score of 2.39 (M 2.39, SD 0.772).

Table 2

Independent t-test for growth and fixed mindset between groups

Mindset	Group	*N*	*M*	*SD*	*df*	*t*	*p*-value
Growth	Male	233	3.94	0.765	642	1.335	0.182
	Female	411	3.86	0.728			
Fixed	Male	233	2.41	0.900	642	0.326	0.744
	Female	411	2.39	0.772			

The differences in growth and fixed mindset between male and female students in the SMTE classroom were tested by independent *t*-test, and it was found that the *p*-values of 0.182 and 0.744, respectively, were greater than 0.05. It could be summarized that there was no statistically significant difference in growth and fixed mindset between males and females. The finding was similar to the study of the Organisation for Economic Cooperation and Development (OECD). The OECD conducted a survey of students' growth mindset in 2018 involving 600,000 students from 78 countries and found that most students, including Thai students, exhibited a growth mindset. (OECD, 2021).

One possible explanation for this finding may be attributed to the relatively short duration used in data collection for the survey. The data collection primarily captures the general beliefs about belief in their intelligence. For specific subjects, however, some studies found gender related to growth mindset as well as the effect on learning outcomes. For instance, in the Physics course, it was found that male and female undergraduate students who began their studies in physics initially showed no significant variations in their growth mindset; however, over time and by the end of the course, distinctions between the genders in terms of their mindset gradually became noticeable (Kalender et al., 2022; Malespina et al., 2022). Particularly, compared to male students, female students held a more "fixed" view of intelligence in the context of physics (Kalender et al., 2022; Malespina et al., 2022; Marshman et al., 2018), Mathematics (Degol et al., 2018; Wang et al., 2021), Mathematics and ICT (Sáinz & Eccles, 2012), and STEM (Eccles, 2011). Future research based on the findings of this study should include the need to investigate the factors influencing the development of growth mindset and to extend the study duration for a more in-depth analysis. This would involve examining whether male and female students in specialised SMTE classrooms exhibit any notable changes in their overall growth mindset over an extended period. Additionally, researchers should explore how specific subjects such as mathematics, physics, chemistry, biology, or STEM influence mindset development.

RQ2 : What Kinds of Achievement Goal Orientations Do Students in the SMTE Classroom Exhibit?

Among male students (N=233), the predominant goal orientation was mastery goal orientation, accounting for the highest percentage at 57%. Following this, performance avoidance goal orientation was the second most prevalent at 15%. Additionally, students who exhibited a combination of three goal orientations represent 11% of the total. For female students (N = 411), the primary goal orientation was mastery goal orientation, which constituted the highest proportion at 61%. Performance avoidance goal orientation was the second most prevalent, at 15%, with students demonstrating a combination of two goal orientations (mastery goal and performance avoidance goal) accounting for 11% of the total. The research findings indicated that both male and female students shared a common achievement goal orientation, with mastery goal orientation being the most prominent (Table 3).

Table 3

Achievement goal orientation among the SMTE students

	Male		Female	
	Male (*N*=233)	Percentage (100%)	Female (*N* = 411)	Percentage (100%)
Mastery Goal	132	57	250	61
Performance Approach Goal	3	1	9	2
Performance Avoidance Goal	34	15	64	15
Two patterns denoted as 1 and 2	10	4	7	2
Two patterns denoted as 1 and 3	24	10	45	11
Two patterns denoted as 2 and 3	5	2	4	1
Three patterns	25	11	32	8

Note. Two patterns denoted 1and 2 represent students with mastery goal and performance approach goal. Two patterns, denoted 1 and 3, represent students with mastery goal and performance avoidance goal. Two patterns, denoted 2 and 3, represent students with a performance approach goal and a performance avoidance goal.

Initially, researchers conceptualised the intelligence mindset as a single spectrum where students could fall anywhere between a strong growth mindset at one end and a strong fixed mindset at the other. In recent years, researchers have employed both continuum models and models with distinct dimensions, allowing students to embrace both, neither, or even a combination of mindsets concurrently (Yeager & Dweck, 2020). The traditional perspective assumed that as students relinquish

a fixed mindset, they would inevitably adopt a growth mindset. However, in a two-factor model, it became conceivable for a student to neither endorse growth nor fixed beliefs, or to endorse both types of beliefs (Cook et al., 2017). The mindsets that students possess are believed to influence their approach to learning. In the case of a fixed mindset, a student is inclined to withdraw from or evade challenging tasks. Conversely, students with growth mindset perceive difficulties as a chance to acquire knowledge and develop skills, and as a result, they embrace such challenges (Muenks & Miele, 2017; Yeager & Dweck, 2012).

RQ3: What Is the Relationship Between Academic Achievement, Growth Mindset, And Personal Achievement Goal Orientation Among SMTE Students?

Academic Achievement exhibited a low negative correlation with fixed mindset ($r = -.133$, $p < .001$) and a low positive correlation with mastery goal ($r = .158$, $p < .001$). Growth mindset displayed a moderate negative correlation with fixed mindset ($r = .-462$, $p < .001$), a moderate positive correlation with mastery goal ($r = .417$, $p < .001$), a low positive correlation with performance approach goal ($r = .189$, $p < .001$) and performance avoidance goal ($r = .184$, $p < .001$). Mastery goal displayed a low correlation with performance approach goal ($r = .265$, $p < .001$) and performance avoidance goal ($r = .225$, $p < .001$). Performance approach goal exhibited a moderate positive correlation with performance avoidance goal ($r = .528$, $p < .001$). Table 5 presents these correlations among variables.

Table 4

Pearson correlations among psychology test scores

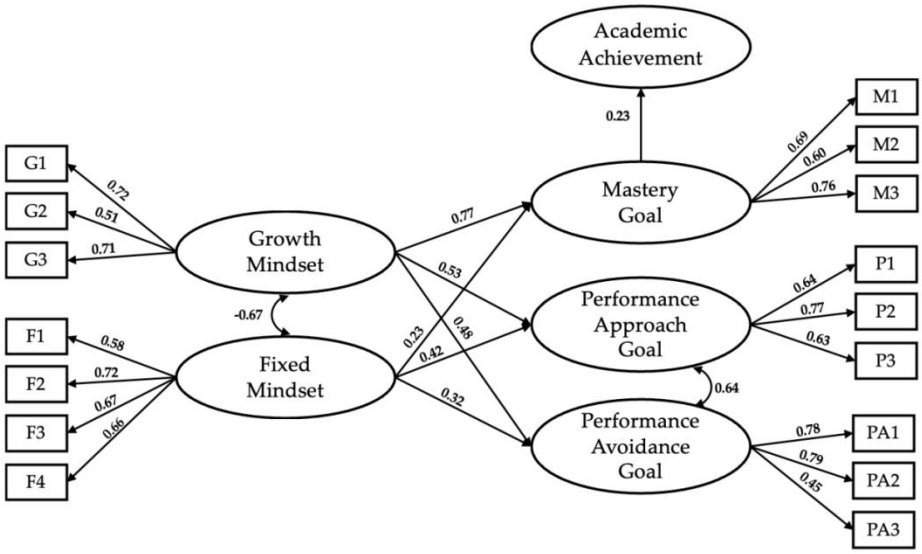
Measures	1	2	3	4	5	6
1. Academic Achievement	-	.090	-.133***	.158***	-.021	.014
2. Growth mindset		-	-.462***	.417***	.189***	.184***
3. Fixed mindset			-	-.198***	.048	.022
4. Mastery goal				-	.265***	.225***
5. Performance approach goal					.-	.528***
6. Performance avoidance goal						-

Note. ***(p <.001)

A structural equation model (SEM) was created in which growth and fixed mindset factors predicted achievement goal factors and the GPA as an academic achievement factor. The model was a good fit (CFI = .901; Gamma hat = .947; RMSEA =.065 (99%CI = .059-.072); SRMR = .047). As shown in Figure 2, the path regressions from growth mindset to mastery goal ($\beta = .77$, $p < .001$), performance approach goal ($\beta = .53$, $p< .001$), and performance avoidance goal ($\beta = .48$, $p< .001$), were significant, which corresponded to the correlations observed for growth mindset and personal goal orientation. Meanwhile, the regressions from fixed mindset to mastery goal ($\beta = .23$, $p = .009$), performance approach goal ($\beta = .42$, $p< .001$), and performance avoidance goal ($\beta = .32$, $p< .001$), were also significant. To predict GPA, only the regression from mastery goal to GPA was significant ($\beta = .23$, $p< .001$. Importantly, the indirect effect results indicated that only the regression path from growth mindset to mastery goal to GPA was significant ($\beta = .18$, $p< .001$). This indicates that mastery goals act as a mediator between growth mindset and GPA, representing academic success.

Figure 2

Results of SEM for growth mindset, achievement goals, and academic achievement



The findings of this study both aligned with and differed from the hypotheses predicted by the conceptual framework of this research. Specifically, the alignment lied in the fact that growth mindset predicted mastery goals, which in turn predicted academic success (GPA) (Chen & Wong, 2014). Midgley et al. (2000) stated that a relationship between mastery learning and growth mindset that when students focused on mastering course content, they were more likely to seek avenues for developing their understanding of the material, where the emphasis was on learning and improvement. However, the differences were that growth mindset also predicted performance approach and performance avoidance goals, and fixed mindset is found to predict both mastery and performance goals. These findings deviated from previous studies (Blackwell et al., 2007; Combette et al., 2024; Yeager & Dweck, 2020). The results might imply that high-ability students tend to have self-expectations, self-confidence, and a desire not to appear unintelligent in the eyes of others. The research findings regarding learning goals were consistent in that the students did not want to appear unintelligent (Yang & Gentry, 2023). The exploration of various cognitive and affective factors that influence school achievement and how cognitive skills instruction could be combined with attempts to create an appropriate affective climate for classroom learning. Research found that most classroom learning occurred in a context involving personal stress, anxiety, and the threat of academic failure (Covington, 2014). In addition, this result could be explained by considering perfectionism. Perfectionism has been associated with a rigid adherence to impossibly high standards, an irrational importance on the attainment of these standards, and a tendency to overgeneralise failures (Fletcher & Speirs Neumeister, 2012). Therefore, this study suggested in the same demeanour as Covington (2014) that teachers of high-ability students should be aware of social cognition and attribution, achievement motivation, fear-of-failure dynamics, and current views of information processing and problem-solving as they apply to actual classroom learning. One of the key findings from the meta-analysis done by Zhang (2022) was the supportive learning environment issue, in which essential tools and resources were necessary for fostering improvement and allowing the transformed mindset messages to interact with student motivation, promoting adaptive behaviours.

Conclusion

This research explored the relationship between mindsets, achievement goal orientation, and academic achievement. The analysis revealed that growth and fixed mindset levels did not significantly differ between male and female students. These students exhibited various goal orientations, including mastery learning, performance-avoidance, and a combination of multiple orientations. This study also suggested key findings regarding the relationship between growth mindset, mastery goals, and academic achievement. Specifically, growth mindset was found to predict mastery goals, which positively influence academic achievement. Additionally, growth mindset also predicted performance-approach and performance-avoidance goals, though these did not directly affect GPA. Interestingly, high-achieving students were found to set both self-improvement goals and comparative learning goals, which differs from previous research that often associates fixed mindset with performance-oriented goals. The results underscore the intricate nature of educational processes, particularly among high-ability students, highlighting the necessity of multifaceted pedagogical strategies to cater to diverse learning requirements. These insights are crucial for developing educational strategies that make students aware of their mindsets and achievement goal orientations, particularly in high-ability student cohorts. They highlight the importance for educators to create environments that do not foster feelings of intellectual inadequacy but instead promote growth mindset and mastery goal, leading to more effective and resilient learning experiences.

Limitations and Recommendations

This study has certain limitations. It relied on the survey data and did not collect data on students' socioeconomic background, family environment, or other contextual factors that might influence their mindsets and learning goals. Furthermore, the study was conducted before students entered a challenging SMTE programme with demanding content and processes. Therefore, future research should consider contextual factors and a longitudinal approach to investigate whether students' mindsets evolve over time and how the passage of time impacts the relationships between mindsets, personal learning goals, and academic achievement. In addition, a controlled experimental study with a manageable sample size could have enabled more detailed of growth mindset development and offered more robust evidence of its impact.

Declaration of Interest

The authors stated that there are no potential conflicts of interest related to this work's research, writing, or publication.

Ethical Statement

The authors acknowledged that the study involved human participants but determined that ethical committee approval was not required, as this survey research was considered low-risk and harmless. Parental consent was obtained for student participation, and participants were informed that their data would be used solely for research purposes, with their identities remaining anonymous in any resulting publications.

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