

Do Achievement Goals Differently Orient Students' Academic Engagement Through Learning Strategy and Academic Self-Efficacy and Vary by Grade

Jianjun Zhong^{1,2,*}, Juan Wen^{1,3,*}, Kuan Li⁴

¹Key Research Institute of Humanities and Social Sciences at Tianjin Universities-Center of Vocational Education Development Research, Tianjin University of Technology and Education, Tianjin, 300222, People's Republic of China; ²School of Vocational Education, Tianjin University of Technology and Education, Tianjin, 300222, People's Republic of China; ³School of Psychology, Inner Mongolia Normal University, Hellingier, 011517, People's Republic of China; ⁴School of Humanities, Inner Mongolia University of Technology, Hohhot, 010080, People's Republic of China

*These authors contributed equally to this work

Correspondence: Jianjun Zhong, Email zhongjj709@tute.edu.cn

Background: Previous cross-sectional studies were on the basis of three categories of achievement goal orientation; therefore, it is not yet possible to fully examine whether achievement goal orientation affects academic engagement through learning strategies and self-efficacy and whether those effects vary by grade. Then, it is necessary to further explore whether different achievement goal orientations affect academic engagement through the mediation of learning strategies and academic self-efficacy from the perspective of integration of achievement goal orientation theory and social cognitive theory under the premise of four classifications of achievement goal orientation, if so, whether there is consistent-path structure between grades.

Methods: Participants were 1429 high school students (647 male, 782 female) were taken as subjects through cluster sampling. The Achievement Goal Orientation Scale, Learning Strategies Scale, Academic self-efficacy Scale, and Academic Engagement Scale were used to measure achievement goal orientations, learning strategies, academic self-efficacy and academic engagement.

Results: The mastery approach, performance approach, and performance avoidance indirectly predicted academic engagement through the chained mediated effects of learning strategies and academic self-efficacy, respectively. There were no direct or indirect predictive effects of mastery avoidance on students' academic engagement. The path structure constructs were consistent across grades, except for grade differences in the predictive relationships between mastery approach on learning strategies and mastery avoidance on learning strategies.

Conclusion: As external achievement goals originate from others, regardless of valence approach or avoidance, performance goals indirectly orient academic engagement through chain multiple mediators of learning strategies and academic self-efficacy. As internal achievement goal originates from the individual itself, the mastery approach not only directly but also indirectly orients academic engagement through chain multiple mediators of learning strategies and academic self-efficacy. The path structure remains consistent but local relations vary across school years in China. Finally, the possible psychological mechanisms of goal orientations are discussed.

Keywords: academic self-efficacy, academic engagement, achievement goal orientation, learning strategies

Introduction

With the development of globalization, education is gradually moving towards communication and integration in various countries. The combination of "learning" as the center, learning process, and value-added results has gradually become a common value trend in educational evaluation. Transforming from a teaching center to engaging in intrinsic motivation driven and process orientation learning of students has become one of the global educational common points. In line with this, the Chinese document "Overall Plan for Deepening the Reform of Education Evaluation in the New Era" (China [2020] No. 19) clearly proposes to improve the academic evaluation system that essentially combines process assessment

and result assessment. The document tended to resolutely change the practice of evaluating students with scores, instead of innovating the process evaluation method of morality, intelligence, physical fitness, aesthetics, and labor. The reforms tended to improve the comprehensive quality evaluation system, steadily promote the comprehensive reform of the college entrance examination, and gradually transform the enrollment model based solely on exam scores. It means that the previous practice of using external learning motivation to guide students to engage in learning by achieving good scores is no longer suitable for the purpose and requirements of education in the new era. How to stimulate students' intrinsic learning motivation, enable them to master effective learning strategies, gain a sense of ability in learning, and then be willing to invest time and energy in learning activities are vital in the new era. The students know how to learn and adhere to long-term high-quality learning has become a trend of educational reform in the new era. Therefore, focusing on the driving mechanism of academic engagement, conducting research on the relationship between high school students' academic engagement and their achievement goal orientation, learning strategies, and academic self-efficacy are vital to promote the global educational reform. The current study research on internal driven, process orientation academic engagement and promote the reform of teaching evaluation in Chinese high and secondary schools has important academic and practice value.

The academic community's understanding of academic engagement is gradually deepening. Initially, researchers considered academic engagement as the sum of the energy and physical energy that students put into learning activities.^{1,2} Later, pedagogical researchers defined academic engagement as the degree of behavioral and emotional involvement of students in initiating and performing learning activities.² Influenced by positive psychology, Schaufeli et al defined academic engagement as a kind of positive psychological state in which individuals are fulfilled, stable, and sustained in their learning activities and consists of three dimensions: Vitality, dedication, and concentration.³ Vitality refers to the individual's active and persistent efforts, active dedication, and self-encouragement to persevere in the face of learning difficulties; dedication refers to students who have a clear understanding of the meaning and value of learning and mobilizing their abundant energy to devote themselves to learning and properly and flexibly dealing with the setbacks and challenges; concentration refers to the joyful state of paying attention to learning wholeheartedly. On this basis, effective measurement tools have also been formed.⁴ This definition is more comprehensive than others, so it has become one of the widely used conceptual frameworks for research on the influencing factors of academic engagement. In reality, the more learning engagement of students often lead to less learning problems and lower dropout rates, these students may also have higher achievement and more positive qualities in school. On the contrary, those students with lower persistence on and attention to learning often cause a lot of learning problems and risk of abnormal psychological development. Researchers have conducted a series of studies on the mechanism of academic engagement and its influencing factors and proposed some conceptual structures, such as dynamic developmental model,⁵ demand-resource model,^{6,7} and situational-motivational process model.^{8,9} Starting from the driving force of achievement goal orientation on behavior, the organization of psychological resources, and the self-efficacy, learning strategies jointly affect academic engagement is one of the important issues that researchers are concerned about.

Achievement Goal Orientation, Learning Strategies, and Academic Engagement

The achievement goal orientation theory believes that achievement goal orientation is the overall tendency of students to approach, participate in, and evaluate academic progress and achievement. The achievement goal orientation includes two components: the source of psychological energy and the direction of goal orientation. Achievement goal orientation reflects individuals' preferences for specific types of expected outcome states, it has the function of motivating, focusing, and maintaining behavior.¹⁰⁻¹³ Later, many researchers defined achievement goals from the perspective of behavioral engagement, they believe that achievement goal orientation refers to an individual's reasons or purposes for engaging in behaviors related to competency, such as ability growth, knowledge, skill mastery, or better grades, more rewards, and more approval performance achievement.¹⁴ Based on the dichotomous and trichotomous categories of goal orientations, many researchers have studied the predictive relationship between achievement goal orientation and learning engagement, and there are different research results. Some researchers found that mastery goals positively predicted academic engagement, performance goals negatively predicted academic engagement,¹⁵ other researchers found that mastery goals, and performance approaches all directly positively predicted academic engagement, and the direct predictive effect of

performance avoidance was not significant.^{16,17} Based on four categories of achievement goal orientations, some studies found that approach goals (mastery and performance) positively predicted academic engagement, and avoidance goals (mastery and performance) were not significant predictors of academic engagement.^{18,19} However, some studies have also found that mastery avoidance negatively predicts affective engagement in learning. Performance avoidance negatively predicts behavioral engagement in learning,²⁰ and positively predicts academic engagement directly or indirectly.²¹ Performance avoidance is one of the learning drivers of engagement. From the above research, it is not difficult to see that achievement goal orientation is one of the learning drivers of engagement.²² However, the specific impact of each achievement goal orientation on academic engagement is still uncertain. The impact of different achievement goal orientations on academic engagement needs further verification.

Learning strategies are mental processes that learners consciously organize to help them learn and understand new things,²³ which includes cognitive strategies, metacognitive strategies, and resource management strategies. In terms of the impact of achievement goal orientation on academic strategies, some researchers have found that achievement goal orientations have different effects on learning strategies, because achievement goal orientation initiate the corresponding commands, decision rules, and reasoning rules and then have corresponding cognitive, affective, and behavioral consequences,^{24,25} generate the different learning strategies to achieve goal orientations.^{26,27} Although researchers have acknowledged the effect of achievement goal orientation on learning strategies, the conclusion on the predictive effect of different achievement goal orientations on learning strategies are not consistent. Some research on the relationship between achievement goal orientation and learning strategies found that only approach goals (mastery and performance) positively predicted students' self-regulatory learning strategies, cognitive and metacognitive strategies,²⁸ whereas avoidance goals (mastery and performance) negatively predicted the use of self-regulatory learning strategies and did not significantly predict cognitive and metacognitive strategies.²⁹ However, other research has also shown that mastery approach directly and positively predicts learning strategies, performance avoidance indirectly and positively predicts it, mastery avoidance indirectly and negatively predicts it, and performance approach does not significantly predict it.³⁰ In this regard, some studies have pointed out that achievement goal orientation has cultural differences in its impact on learning. Achievement goal orientation has a certain positive effect on individual learning engagement in the context of collectivist culture.^{31,32} These studies indicate that even the impact of achievement goal orientation convergence on learning strategies may not be entirely positive, and the avoidance of achievement goals may not be entirely negative. It is likely related to the cultural attributes of the learning context and the need to learn contextualized goals, as well as to the individual's achievement goal orientation development. Therefore, the impact of achievement goal orientation on learning strategies can be both general and specific due to differences in learning scenarios. Therefore, further research is needed on the general and specific effects of each achievement goal orientation on learning strategies.

Research on the impact of learning strategies on learning engagement has found that effective learning strategies often lead to better learning engagement. Research has shown that strategy teaching based on gamified learning, cooperative learning, and group learning can improve the learning engagement of college students.³³ The better the mastery of self-regulated learning strategies, the higher the level of online learning engagement of college students.³⁴ The reason for this may be that effective learning strategies can generate or increase learning satisfaction and positive emotional experiences such as happiness and enjoyment. These positive emotional experiences may broaden the thinking and action pool or behavioral habit patterns, including human attention, cognition, and action range, which may enhance learning engagement, including vitality, dedication, and concentration.³⁵ Therefore, by combining the impact of different achievement goal orientations on learning strategies and the predictive effect of learning strategies on learning engagement, it can be inferred that different achievement goals may have different effects on learning engagement through learning strategies. Moreover, due to different achievement goal orientations, the mediating role of learning strategies between achievement goals and learning engagement may not be consistent. It is necessary to explore the impact mechanism of different achievement goal orientations on learning engagement through learning strategies.

Achievement Goal Orientation, Academic Self-Efficacy, and Academic Engagement

Self-efficacy is an individual's beliefs, expectations, and judgments about the ability to perform a task in a given domain.³⁶ Academic self-efficacy belongs to domain self-efficacy, which refers to the self-efficacy of students in the field of learning activities. It refers to individuals' beliefs, expectations, and judgments about their ability to complete specific learning tasks or achieve certain goals in their own learning or execution behavior during learning activities.³⁷ The level of self-efficacy is closely related to people's mastery of experience in activities, successful demonstration of role models, supportive language, and positive emotional experiences, among which mastery direct experience is an important source of self-efficacy.^{38,39} Based on these experiences, self-efficacy generated through processes related to self-qualifications, which reflects individuals' expectations of controllable behavioral activities. The higher academic self-efficacy, the easier it is to participate, strive, persist, and achieve good results in learning.⁴⁰ Therefore, academic self-efficacy is one of the prerequisites for successful learning activities.⁴¹

Regarding the mediating role of academic self-efficacy between achievement goals and learning engagement, researchers primarily studied the impact of achievement goal orientation on academic self-efficacy. The achievement goal orientation theory holds that in goal pursuit activities, expected goals not only play an organizational role in the activity process but also play a goal orientation evaluation role in the activity. While social cognitive theory holds that self-efficacy is often generated by people making meaningful evaluations of their own performance through social comparisons with others or reference comparisons with the self,⁴² it means that different achievement goal orientations will lead to different levels of self-efficacy. Some studies have found that approach goals (mastery and performance) have a positive predictive effect on academic self-efficacy,^{21,43} but the findings on avoidance goals' effect on the academic self-efficacy are inconsistent. Some researchers found that avoidance goals have a negative predictive effect on academic self-efficacy,⁴⁴ others got result that they have no significant predictors of academic self-efficacy,⁴³ while others had different result like that performance avoidance positively predicts academic self-efficacy.²¹ Second, the researchers conducted a study on the impact of self-efficacy as a behavioral control factor on academic engagement. Starting from the perspective of the controllable expectation of action of academic self-efficacy, researchers have also explored the impact of academic self-efficacy on learning engagement. Among these studies, the control valence model has a significant impact. The control-value theory starts from the expected value motivation theory, which believes that the value and controllability of learning activities affect learning engagement, among which academic self-efficacy is an important indicator of the controllability of learning activities. This model found that academic self-efficacy positively predicts learning engagement, high or low self-efficacy unconsciously activates positive or negative emotions through controllability assessment, which in turn affects academic engagement. Self-efficacy as a controllable factor becomes an important source of behavioral motivation^{45–47}. The research on the relationship between the three factors also found that achievement goal orientations can influence academic engagement through the mediating role of academic self-efficacy.^{21,48} From the above, the effects of mastery orientation and performance orientation on academic self-efficacy are positive, while the impact of mastery avoidance on academic self-efficacy is not significant, and the effects of performance avoidance on academic self-efficacy are inconsistent. The emergency of this different result may be related to the individual's level of achievement goals and its structure itself. Individuals with approach goal orientations tend to spend more energy on activity, and there is a possibility of more progress, which gives individuals more positive emotional arousal. The positive emotional arousal can make them less likely to pay attention to losses but focus more on gains than avoidance goals. Therefore, the mastery orientation has better self-efficacy than the performance orientation. There is no correlation between avoidance goal orientation and self-efficacy, it is likely due to its lower level in the achievement goal orientation structure, the avoidance goal orientation has a lower goal drive for human behavior activities and does not play a role in goal evaluation of behavioral effects. In addition, it may also be due to different learning stages, learning evaluation requirements, and measurement tools. Therefore, in order to enhance understanding of the joint relationship among the mastery approach orientation, avoidance orientation, and self-efficacy, it is necessary to use a unified tool to further explore the relationship between the achievement goal orientation, academic self-efficacy, and learning engagement.

Chain Mediation of Learning Strategies and Academic Self-Efficacy

Social cognitive theory suggests that one of the four major sources of information about self-efficacy and the most influential is mastery experience.³⁶ Social evaluation information on the activity and self, individual's emotional responses accompanying the activity, and the individual's sense of control over the activity itself are important sources of self-efficacy.^{47,49} Mastery experience is the direct experience of an individual's abilities from his or her own personal actions. Improving mastery experience can contribute to an individual's sense of self-efficacy, for example, an individual's acquisition of coping skills related to a task to promote mastery experience can contribute to self-efficacy.^{36,39,50} Students' acquisition of broad and deep learning strategies implies the possession of effective study skills that will enhance their competent experiences and controllability beliefs about learning, which in turn will increase academic self-efficacy.^{51,52} Although self-efficacy is closely related to experiences, such as the social evaluation of self, emotional experiences and control experience during the activity, the essence of self-efficacy is derived from the basic need of competence, which is a motivational function to a certain extent.^{53,54} In learning activities, due to the content and valence of achievement goal orientations, there are different self content experiences and self competence standards, which are precisely important sources of self-efficacy. The self-efficacy built on these sources will further affect learning engagement by self experiences and evaluations such as self confidence, self control and self belief.^{45,49} In general, when an individual uses more effective learning strategies, he will make greater progress on the goal and may perform better than others, they will get better self-experience and higher sense of self-efficacy. From this, it can be further inferred that in the impact of achievement goal orientation on learning engagement, learning strategies and academic self-efficacy have a chain mediating effect.

Group Differences in Achievement Goal Orientation by Learning Strategies and Academic Self-Efficacy on Academic Engagement

Individual goals and affective, cognitive, and social needs develop with age,⁵⁵ and adolescent students have grade-level differences in their achievement goal orientations, learning strategies, and academic self-efficacy.^{56,57} So, the relationships between achievement goal orientation, learning strategies, academic self-efficacy, and engagement in learning may differ by grade. In China, when adolescents enter high school, they start a period of self-management and realize that acquiring as much knowledge as possible and avoiding a relatively unfavorable ranking position in terms of performance score, which is crucial for future college entrance examination selection, which becomes the main tone of achievement goal orientation in high school learning. However, in high school, the first year of admission is a period of adjustment to a new learning environment, and the students may be full of new hopes in the new stage, while the senior year is a period of pressure to advance to college education, and students have to spend more energy and time in learning than the other grades. The students of the three grades of high school are in the same development stage; however, they might be in different goal-pursuit situations. However, there are few studies on grade differences in the effects of achievement goal oriented on learning engagement through the mediation of learning strategies and self-efficacy of high school students. Chinese high school students are required to undergo two types of evaluative exams: in the first and second year of high school, they are required to take the academic level standard exam, but in the third year, they are required to participate in the university selection entrance exam. The former emphasizes mastery goals, while the latter focuses on achievement goals. In this situation, specific research is needed on how achievement goal orientations affect learning engagement through the mediation of learning strategies and self-efficacy among different grades.

The Questions, Hypotheses, and Purposes

Through the above discussion, it can be found that mastery goal orientation and performance approach goal orientation have stable positive effects on learning strategies, self-efficacy, and learning engagement, while the predictive effect of mastery avoidance goal orientation and performance avoidance goal orientation are not stable. The above different results may be due to the inconsistent of constructions and measurement tools. Therefore, it is necessary to use a unified goal orientation construction and corresponding measurement tools to further explore how each achievement goal orientation affects learning engagement through the mediation of learning strategies and self-efficacy at the same developmental

stage. The research has found that achievement goal orientation has cultural differences in its impact on learning, where performance goal orientation has a certain positive effect on individual learning engagement in the context of collectivist culture.^{31,32} Moreover, students' achievement goal orientations are unstable, influenced by the requirements of mastering knowledge and competitive situations, their achievement goal orientation may also change.^{58,59} From this perspective, the occurrence of inconsistent results may also be caused by the different learning period or learning situation. The dominant structure of achievement goal orientation varies among junior high school, high school, and university stages. Influenced by further education, the level of achievement goal orientation plays a dominant role in the junior and high school stages, while mastery of achievement goal orientation may play a dominant role within the university stage. The same academic period may also have different requirements in different academic years, resulting in varying effects of achievement goal orientation on learning strategies, self-efficacy, and learning engagement during academic years. Therefore, when considering the same academic period, it is necessary to further explore whether the impact of various achievement goal orientations on learning engagement mediated by learning strategies and self-efficacy varies due to the learning requirements of the academic year.

With the in-depth research on achievement goal-oriented classification, four categories of achievement goal orientations were brought up and confirmed. Compared to the dichotomy of mastery goal orientation and performance goal orientation focusing on content orientation, the trichotomy of mastery goal orientation, performance goal orientation, and performance avoidance goal orientation, the four classification achievement goal oriented divides achievement goal orientation into mastery approach, mastery avoidance, performance approach, and performance avoidance direction, which is based on whether the goal orientation content is oriented towards mastery or achievement, and whether the goal orientation validity is approaching or avoiding. A four classification achievement goal-oriented measurement tool is more comprehensive.^{60,61} This provides a panoramic framework for observing the content and valence effects of achievement goal orientations on academic engagement by chain mediators of learning strategy and academic self-efficiency. Being different from the Western University Admission System based on personal interest and academic standard performance, Chinese high school students face two types of exams: one is the academic standard reference exam that runs through the first, second, and third years of high school, and the other is the national standardized college entrance exam in the third year of high school. Only students who pass the academic standard exam can participate in the standardized reference college entrance exam. It means that students' mastery and achievement goal orientation will change with learning requirements, the learning strategies, self-efficacy, and learning engagement may also change accordingly. By selecting three grades of Chinese high school students as subjects, the impact of achievement goal orientation on learning engagement through learning strategies and self-efficacy can be better explored as well as whether it varies with academic years. The current study has provided a localized research scenario.

The theory of achievement goal orientation believes that when individuals focus on increasing their new understanding by figuring out the implicit knowledge in the task, the individual's internal purpose is integrated with the specific learning process itself, and the individual is directly involved in the learning activity. When the individuals focus on whether the results of the activity are superior to others, the individual's own internal purpose is looted by the processing of the result state. Internal purpose is indirectly connected with the current learning activity, and the individual driven by external forces is indirectly invested in the learning activity. From the perspective of valance, approach valence makes people more willing to be involved in the learning process, while avoidance valence generates limited engagement in the learning process due to indirect fear of the occurrence of certain feared outcomes. Thus, in terms of the predictive effect of achievement goal orientation on learning engagement, the first set of hypotheses are proposed: 1. due to content reference pointing to task directly or indirectly, mastery orientations directly predict academic engagement, while performance orientations indirectly predict academic engagement; 2. because of valence points, performance approach indirectly and positively associates with academic engagement, while performance avoidance indirectly and negatively predicts academic engagement. In terms of the impact of achievement goal orientation on learning strategies, the second set of hypotheses are formulated as follows: 1. approach goal orientations (mastery and performance) affect academic engagement by positively predicting learning strategy mediation; 2. whereas avoidance goal orientations

(mastery and performance) affect academic engagement by negatively predicting learning strategy. In China, affected by The National College Entrance Examination whose admission criterion is the rank of the score among the candidates and Ordinary High School Academic Proficiency Test whose passing standard is basic mastery, high school students always master as much learning content as possible, they rank as high as possible in academic performance, try not to fail to master the learning content, and try not to fall behind more people in academic performance. Guided by these goal orientations, high school students devote themselves to high school learning activities, and use goal orientation content to define experience self and goal orientation valence to examine experience self-value in learning, which forms academic self-efficacy. Whereby the third set of hypotheses are proposed: 1. approach goals (mastery and performance) positively predict academic self-efficacy; 2. the avoidance goals (mastery and performance) negatively predict academic self-efficacy; and self-efficacy positively predicts academic engagement. Combining the above discussion on learning strategies on academic self-efficiency, thus the fourth set of hypotheses are proposed: 1. the learning strategies predict students' academic self-efficacy; 2. the academic self-efficacy predicts academic engagement. The stages of psychological development are generally similar in the same academic year, but due to different evaluation requirements in academic years, the systematic impact of achievement goal orientation on learning varies may be different. Thus, the fifth set of hypotheses are proposed: 1. the influence mechanisms of achievement goal orientation, learning strategies, and academic self-efficacy on academic engagement in high school are consistent across grades; 2. the local relationships are quantitatively different across grades because of the different situations of grades.

According to the above assumptions, it is possible to understand the joint impact of achievement goal orientation on learning engagement through the mediation of learning strategies and academic self-efficacy, as well as the driving mechanism of the impact of achievement goal orientation on learning engagement in the context of Chinese high school exams. The current study not only enriches the general theoretical understanding of the impact of achievement goal orientation and self-efficacy on the motivation of learning engagement but also enhances the general theoretical understanding of the organizational motivation of learning engagement mediated by learning strategies and self-efficacy. Moreover, by studying the grade differences in the impact of achievement goal orientation on learning engagement among high school students in the context of Chinese college entrance examination learning, it can enrich the local psychological research on the dynamic impact of achievement goal orientation on learning engagement among Chinese high school students. The current study may also provide empirical evidence for the effects of achievement goals on learning engagement in different learning contexts.

Method

Subjects and Procedures

With the approval of the psychological research ethics committee of the researcher's institution, a whole-group sampling method was used, and with the consent of the students themselves, an anonymous survey was conducted in a high school of the Inner Mongolia Autonomous Region from November to December 2021. A total of 1537 questionnaires were distributed in paper and online forms to 39 classes of senior high school. A total of 108 questionnaires were removed for 67 questionnaires with regular responses and 41 questionnaires with response times less than 300 seconds. 1429 valid questionnaires were left eventually, the effective survey rate was 92.97%. The basic information of the research object is shown in Table 1.

Table 1 Basic Information of the Study Subject

Variables	Students	Number	M_{age}	SD_{age}
Gender	Male	647	16.50	1.11
	Female	782	16.50	1.05
Grade	One	543	15.63	0.64
	Two	489	16.54	0.60
	Three	397	17.64	0.73

Research Instruments

The Achievement Goal Orientation Scale developed by Elliott &⁶¹ and revised by Chen⁶² was used, which has four factors with three items per factor, for a total of 12 items. Students made a choice of how similar the description of each item was to themselves on a Likert scale from 1 (not at all) to 7 (fully), and the items corresponding to the factor were summed to indicate the score for that factor, with higher scores indicating a greater tendency toward a particular type of achievement goal orientation. In the present study, the scale's reliability and confirmatory factor analysis were done based on present data, the same is true for the other four scales. The Cronbach's alpha for the mastery approach factor was 0.849; the Cronbach's alpha for mastery avoidance was 0.816; the Cronbach's alpha for achievement approach was 0.786; the Cronbach's alpha for achievement avoidance was 0.779, and the total scale Cronbach's $\alpha = 0.844$. Confirmatory factor analysis (CFA) revealed a good model fitting index, $\chi^2/df = 7.308$, CFI = 0.960, TLI = 0.945, RMSEA = 0.066 [0.060, 0.073], SRMR = 0.051, and the acceptable standard factor load range was from .552 to .865.

The Learning Strategies Scale jointly developed by Zhang and Zhang (2006) was used to measure learning strategies. The scale has 77 items and 3 second-order factors, and the Cronbach's alpha of the total scale is .97. The cognitive strategy contains three dimensions of retelling, refinement, and organization, with a total of 24 items (eg, "I often recall what I have learned repeatedly in my mind until I remember it", Cronbach's alpha = 0.927). The metacognitive strategy contains three dimensions of planning, monitoring, and regulation, with a total of 26 items (eg, "I can organize my learning activities throughout the day", Cronbach's alpha = 0.924). Resource management strategies include three dimensions of time management, environment management, effort management, and support seeking, with a total of 27 items (eg, "Before learning a new lesson, I often schedule time to pre-study", Cronbach's alpha = 0.850). Students indicated their responses on a 5-point Likert scale ranging from 1 (not at all) to 5 (fully). Where 11, 12, 17, 21, 31, and 75 are reverse scoring questions, the dimensions corresponding to each second-order factor can be summed, and higher scores indicate better learning strategies. Confirmatory factor analysis (CFA) revealed a good model fitting index, $\chi^2/df = 15.992$, CFI = 0.960, TLI = 0.944, RMSEA = 0.102 [0.095, 0.110], SRMR = 0.033, and the acceptable standard factor load range was from 0.410 to 0.911.

Academic self-efficacy, which was developed by Midgley et al,⁶³ was revised by Chen et al.⁶⁴ The questionnaire consists of six items (eg, "I believe I can master the knowledge and skills I learned in class"). The scale Cronbach's alpha = 0.863, and students indicated their responses on a 5-point Likert scale ranging from 1 (not at all) to 5 (fully). Higher scores indicate better academic self-efficacy. Confirmatory factor analysis (CFA) revealed a good model fitting index, $\chi^2/df = 26.590$, CFI = 0.937, TLI = 0.896, RMSEA = 0.134 [0.119, 0.149], SRMR = 0.040, and the acceptable standard factor load range was from 0.620 to 0.826.

The Academic Engagement Scale, which was developed by Schaufeli et al,⁴ was revised by Fang et al.⁶⁵ The scale consists of 17 items, six of which measure vitality (eg, "I am happy to study as soon as I get up in the morning", Cronbach's alpha = 0.828); five items measure dedication (eg, "I find studying challenging", Cronbach's alpha = 0.866); 6 items measure concentration (eg, "When I study, I forget everything around me", Cronbach's alpha = 0.851), and the total scale Cronbach's alpha = 0.933. Students indicated their responses on a 7-point Likert scale ranging from 1 (never) to 7 (always). Higher scores indicated higher levels of academic engagement. Confirmatory factor analysis (CFA) revealed a good model fitting index, $\chi^2/df = 11.632$, CFI = 0.904, TLI = 0.887, RMSEA = 0.086 [0.082, 0.090], SRMR = 0.043, and the acceptable standard factor load range was from 0.513 to 0.808.

Data Analysis

In order to test whether there is a common method bias due to the data all come from the measurement methods, factor analysis in SPSS 24.0 was used for the Harman one way common method bias test. Descriptive analysis, analysis of variance, and Pearson product difference correlation analysis were used for the main variables. In order to test the path model of learning engagement influenced by various achievement goal orientation through the mediation effect of learning strategies and self-efficacy, Mplus 8.3 was used for bootstrap analysis of structural equation model for mediating effects. Amos 24.0 was used for confirmatory factor analysis and multi-group analysis to test whether the path coefficients between the variables were consistent across grades.

Results

Test for Common Method Bias

Because the self-report method of data collection is possible due to common method bias affecting the study results,⁶⁶ an exploratory factor analysis was conducted on all topics using the Harman one-way test. The results showed that there were 17 factors with eigenvalues greater than 1, explaining 57.46% of the variance, and the amount of variance explained by the first factor was 27.86%, indicating that there was no common method bias across the measurement instruments according to the critical value criterion of less than 40% of the variance explained by the first factor.

Descriptive and Correlational Analyses

One-way ANOVA was used to analyze the differences in achievement goal orientation, learning strategies, academic self-efficacy, and academic engagement among grades. For achievement goal orientations, senior one and senior two are higher than senior three, and there is no significant difference between senior one and senior two. For cognitive strategy, resource management strategy, learning strategy, learning investment and academic engagement dimensions, senior two is higher than senior one, senior two is higher than senior three, and there is no significant difference between senior one and senior three. In general, the second year of senior high school shows better learning adaptability. The results of the $M \pm SD$, F value, and posttest are shown in Table 2.

As shown in Table 3, the two-way correlations between the variables were significant, except for the nonsignificant correlations between performance avoidance and metacognitive strategies ($r=0.041$, $p>0.05$), resource management strategies ($r=0.014$, $p>0.05$), and learning strategies ($r=0.049$, $p>0.05$). This may be because performance avoidance goals usually have a hindering effect on active learning.⁶⁷

The Mediating Role of Learning Strategies and Academic Self-Efficacy Between Achievement Goal Orientation and Academic Engagement

Figure 1 Normalized Path Coefficient Diagram of the Model. A rectangle represents a specific measurement item, while an ellipse represents a latent variable; The line between latent variables and explicit variables represents the factor load,

Table 2 Descriptive and F Variance Analysis Between Different Grades

Variable	Senior 1 (n=543)	Senior 2 (n=489)	Senior 3 (n=397)	Grade Difference	
	$M \pm SD$	$M \pm SD$	$M \pm SD$	F	p
MAP	5.74 \pm 1.25	5.83 \pm 1.24	5.36 \pm 1.31	16.44	0.00 ***
MAV	5.43 \pm 1.41	5.40 \pm 1.37	5.01 \pm 1.36	12.38	0.00 ***
PAP	4.05 \pm 1.57	3.90 \pm 1.67	3.78 \pm 1.51	3.40	0.034*
PAV	4.79 \pm 1.52	4.52 \pm 1.57	4.14 \pm 1.17	20.92	0.00 ***
CST	3.22 \pm .69	3.31 \pm .69	3.12 \pm .65	8.77	0.00 ***
MST	3.15 \pm .68	3.33 \pm .64	3.15 \pm .60	11.73	0.00 ***
RST	3.17 \pm .55	3.30 \pm .53	3.19 \pm .50	7.70	0.00 ***
LST	3.18 \pm .61	3.31 \pm .59	3.15 \pm .54	9.49	0.00 ***
ASE	3.56 \pm .86	3.66 \pm .83	3.42 \pm .76	9.59	0.00 ***
VIT	4.23 \pm 1.15	4.42 \pm 1.14	4.14 \pm 1.14	7.24	0.00 ***
DED	4.66 \pm 1.34	5.03 \pm 1.26	4.61 \pm 1.20	15.16	0.00 ***
CON	4.57 \pm 1.25	4.84 \pm 1.19	4.46 \pm 1.18	12.01	0.00 ***
ENG	4.49 \pm 1.14	4.76 \pm 1.10	4.40 \pm 1.04	13.54	0.00 ***

Notes:* $P<0.05$, *** $P<0.001$.

Abbreviations: MAP, Mastery approach; MAV, Mastery avoidance; PAP, Performance approach; PAV, Approach avoidance; CST, Cognitive strategies; MST, Meta-cognitive strategies; RST, Resource management strategies; LST, Learning strategies; ASE, Academic self-efficacy; ENG, Academic engagement; VIT, Vitality; DED, Dedication; CON, Concentration.

Table 3 Correlation Coefficient Among Variables and Their Means and Standard Deviations

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1.MAP	1												
2.MAV	0.63**	1											
3.PAP	0.16**	0.297**	1										
4.PAV	0.28**	0.365**	0.41**	1									
5.CST	0.37**	0.294**	0.10**	0.08**	1								
6.MST	0.41**	0.29**	0.09**	0.04	0.88**	1							
7.RST	0.38**	0.26**	0.06*	0.01	0.78**	0.86**	1						
8.LST	0.40**	0.29**	0.08**	0.049	0.95**	0.97**	0.92**	1					
9.ASE	0.484**	0.38**	0.16**	0.11**	0.46**	0.47**	0.43**	0.48**	1				
10.VIT	0.41**	0.29**	0.06*	0.076**	0.52**	0.55**	0.52**	0.56*	0.46**	1			
11.DED	0.47**	0.36**	0.09**	0.087**	0.55**	0.58**	0.54**	0.58**	0.51**	0.74**	1		
12.CON	0.40**	0.31**	0.08**	0.064*	0.55**	0.56**	0.53**	0.58**	0.46**	0.72**	0.77**	1	
13.ENG	0.47**	0.36**	0.09**	0.083**	0.59**	0.62**	0.58**	0.63**	0.526**	0.89**	0.92**	0.91**	1
M	5.67	5.30	3.92	4.52	3.22	3.2	3.22	3.22	3.56	4.27	4.78	4.63	4.56
SD	1.28	1.39	1.59	1.54	0.68	0.65	0.53	0.59	0.835	1.15	1.28	1.22	1.11

Note: * $P < 0.05$, ** $P < 0.01$.

Abbreviations: MAP, Mastery approach; MAV, Mastery avoidance; PAP, Performance approach; PAV, Approach avoidance; CST, Cognitive strategies; MST, Meta-cognitive strategies; RST, Resource management strategies; LST, Learning strategies; ASE, Academic self-efficacy, ENG, Academic Engagement, VID, and Vitality.

the number on the line represents the factor load, the line between latent variables represents the influence path, and the number on the line represents the influence coefficient, ** $P < 0.01$, *** $P < 0.001$.

Structural equation analysis was conducted on the effect of achievement goal orientation on academic engagement mediated by learning strategies and academic self-efficacy, and the results showed that the model had a good fit index ($\chi^2 = 1140.613$, $df = 231$, $\chi^2/df = 4.938$, $CFI = 0.955$, $TLI = 0.946$, $RMSEA = 0.052$ [90% CI: 0.049, 0.056], $SRMR = 0.045$, $N = 1429$). The specific path coefficients are shown in Figure 1. Ninety-five percent confidence intervals for the mediating effects were obtained for a sample of 5000 draws. If the confidence interval does not contain 0, then the mediation effect is significant, and if it contains 0, then the mediation effect is not significant.⁶⁸ The direct paths of mastery avoidance, performance approach, and performance avoidance to academic engagement were not significant (shown in Table 4), and except for the paths from mastery avoidance through learning strategies and academic self-efficacy to academic engagement, all other indirect paths were significant.

The Comparative Analysis of Cohort Differences

First, mediation models of the three grades were established. The indicators of the model in the three grades and multi-group comparisons are shown in Table 5. The results showed that the fit coefficients of the grade models and the unrestricted model were good. The latter indicated that the model configurations were all equal across grades, the cardinality difference ($\Delta\chi^2 = 40.58$) between the measurement weight model and the unrestricted model did not reach a significant level ($p = 0.20 > 0.05$), and the null hypothesis was accepted. This result indicated that the measurement components of the model were equal and stable among the first, second, and third grades. The chi-squared difference ($\Delta\chi^2 = 100.635$) of the structural weight model reached a significant level ($p = 0.002 < 0.01$), which indicates that the structural weights of the model are not equal, ie, there is a quantitative difference in the closeness of the relationship between the variables of the 3 cluster models for the grades.

To further investigate which local relationships have quantitative differences, the critical ratio values of the path coefficients were compared, and when the absolute value of the critical ratio is greater than 1.96, there is a difference in a path coefficient between the 2 groups.⁶⁹ From Table 6, it can be found that there is a significant difference between the paths of mastery approach-learning strategy and mastery avoidance-learning strategy in the first and third years of high school. The coefficients of the mastery-avoidance-learning strategy pathway were significantly larger in the senior year

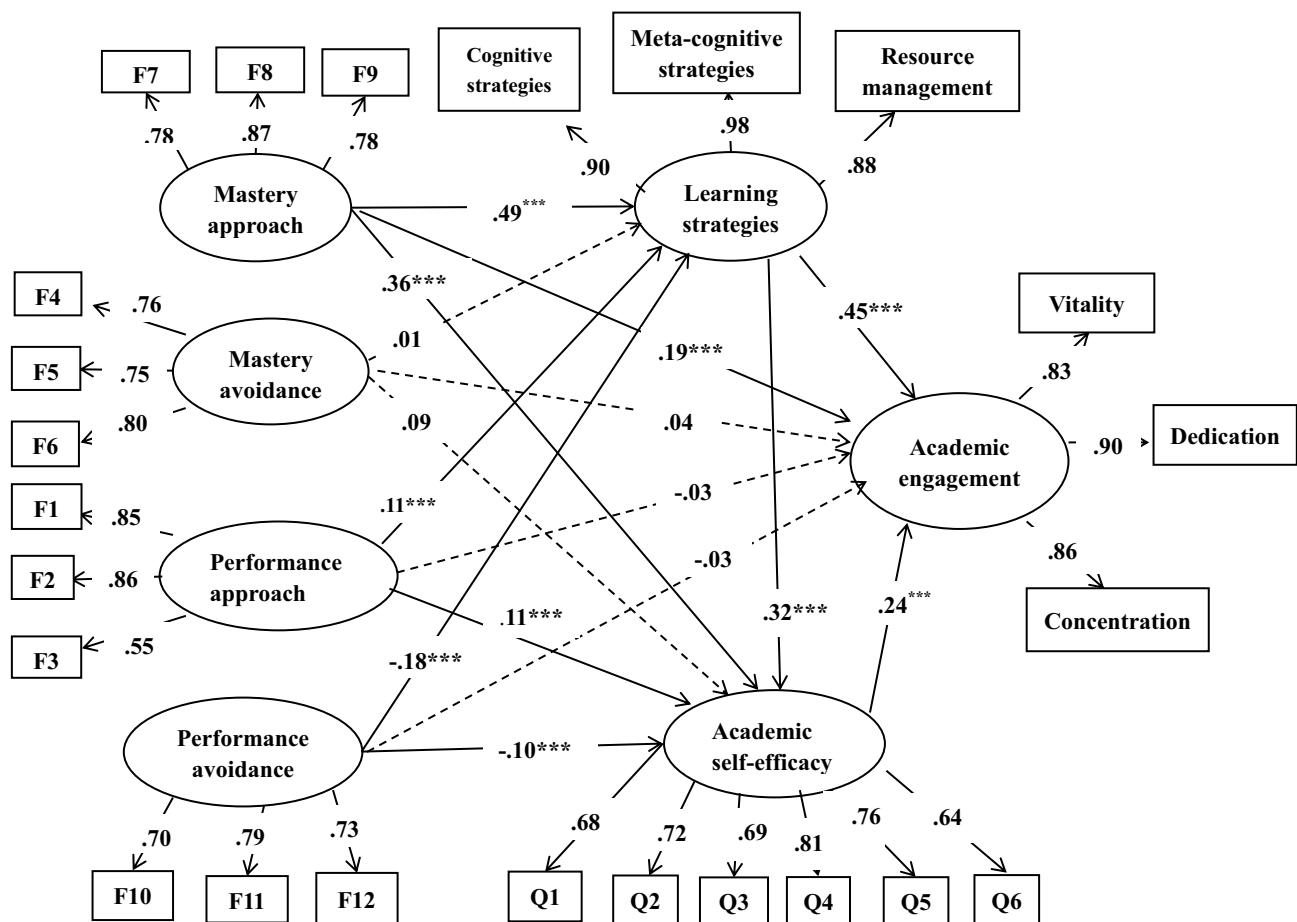


Figure 1 Normalized Path Coefficient Diagram of the Model. A rectangle represents a specific measurement item, while an ellipse represents a latent variable; The line between latent variables and explicit variables represents the factor load, the number on the line represents the factor load, the line between latent variables represents the influence path, and the number on the line represents the influence coefficient; ***P<0.001.

than in the junior year. In the sophomore and junior years, there was a significant difference between the mastery approach-learning strategy pathways specifically; the coefficients of the mastery approach-learning strategy pathways were significantly larger in the sophomore year than in the junior year.

Table 4 Standardized Bootstrap Mediated Effect and Its Test

Master				Performance			
Paths	Effect	95% CI		Paths	Effect	95% CI	
		Lower	Upper			Lower	Upper
MAP→ENG	0.194	0.077	0.308	PAP→ENG	-0.025	-0.079	0.032
MAP→LST→ENG	0.222	0.173	0.281	PAP→LST→ENG	0.048	0.019	0.080
MAP→ASE→ENG	0.086	0.052	0.129	PAP→ASE→ENG	0.026	0.011	0.045
MAP→LST→ASE→ENG	0.038	0.024	0.055	PAP→LST→ASE→ENG	0.008	0.003	0.015
MAV→ENG	0.042	-0.068	0.159	PAV→ENG	-0.028	-0.090	0.037
MAV→LST→ENG	0.005	-0.046	0.057	PAV→LST→ENG	-0.080	-0.118	-0.046
MAV→ASE→ENG	0.021	-0.006	0.054	PAV→ASE→ENG	-0.024	-0.045	-0.008
MAV→LST→ASE→ENG	0.001	-0.008	0.010	PAV→LST→ASE→ENG	-0.013	-0.022	-0.007

Abbreviations: MAP, Mastery approach; MAV, Mastery avoidance; PAP, Performance approach; PAV, Approach avoidance; CST, Cognitive strategies; MST, Meta-cognitive strategies; RST, Resource management strategies; LST, Learning strategies; ASE, Academic self-efficacy; ENG, Academic engagement; VIT, Vitality; DED, Dedication; CON, Concentration.

Table 5 Invariance Analysis of the Multi-Group Model

Fitting Index	χ^2	df	χ^2/df	$\Delta\chi^2$	P	RMSEA	CFI	TLI	SRMR
Senior one model	721.10	231	3.12			0.063	0.94	0.92	0.053
Senior two model	51.87	231	2.21			0.050	0.96	0.95	0.045
Senior three model	521.27	231	2.25			0.056	0.93	0.92	0.055
Unrestricted model	1749.57	693	2.53	–		0.033	0.95	0.94	0.055
Measurement weight model	1790.15	727	2.46	40.58	0.20	0.032	0.95	0.94	0.055
Structural weight model	1850.21	757	2.44	100.635**	0.002	0.032	0.95	0.94	0.057

Note: ** $p < 0.01$.

Table 6 Comparison of Path Coefficients and Differences Among Grades

Paths	Senior 1		Senior 2		Senior 3		Critical Ratio Value		
	β	P	β	P	β	P	1 VS 2	1 VS 3	2 VS 3
MAP→LST	0.59***	0	0.56***	0	0.25**	0.007	–0.46	–3.81***	–3.20***
MAV→LST	–0.12	0.09	–0.008	0.93	0.20*	0.04	0.88	2.51**	1.50
PAP→LST	0.14**	0.008	0.02	0.70	0.11	0.09	–1.68	–0.37	1.10
PAV→LST	–0.19**	0.001	–0.07	0.31	–0.24***	0	1.37	–0.55	–1.79
LST→ASE	0.35***	0	0.27***	0	0.31***	0	–0.58	–0.57	–0.02
MAP→ASE	0.32***	0	0.44***	0	0.31***	0.002	1.19	–0.80	–1.958
MAV→ASE	0.10	0.18	0.16	0.08	–0.05	0.50	0.58	–1.02	–1.41
PAP→ASE	0.11*	0.019	0.12*	0.02	0.08	0.26	0.06	–0.49	–0.54
PAV→ASE	–0.09	0.10	–0.17*	0.005	–0.05	0.50	–1.24	0.47	1.53
LST→ENG	0.47***	0	0.45***	0	0.42***	0	–0.31	–0.22	0.06
ASE→ENG	0.20***	0	0.28***	0	0.26***	0	–0.06	1.10	0.47
MAP→ENG	0.22***	0.004	0.09	0.26	0.24**	0.002	–1.17	–0.11	1.12
MAV→ENG	0.003	0.96	0.11	0.16	0.04	0.62	1.05	0.37	–0.59
PAP→ENG	–0.005	0.91	–0.07	0.13	0.006	0.91	–0.95	0.16	0.95
PAV→ENG	–0.05	0.28	–0.05	0.38	0.05	0.37	0.03	1.37	1.26

Notes: * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Abbreviations: MAP, Mastery approach; MAV, Mastery avoidance; PAP, Performance approach; PAV, Approach avoidance; CST, Cognitive strategies; MST, Meta-cognitive strategies; RST, Resource management strategies; LST, Learning strategies; ASE, Academic self-efficacy; ENG, Academic engagement; VIT, Vitality; DED, Dedication; CON, Concentration.

Discussion

The Effect of Achievement Goal Orientations on Academic Engagement

There are positive correlations between the four achievement goal orientations and academic engagement, and the mastery orientations are higher than the performance orientations (shown in Table 1). The average achievement orientations are greater than the median value of 3.5 (shown in Table 2), it shows that the achievement goal orientations of Chinese high school students are not single but comprehensive, the result is consistent with the learning requirements of Chinese high school education for students. In China's junior high school, students who get grade C or above C in the academic level examination can graduate and then take college entrance examination. Grade scores in the academic level examination is standard reference. Admission to the University Entrance Examination is based on the student's ranking. In this way, comprehensive achievement goal orientations need students to try to master more than they do not know, and they should be as far ahead as possible in the rankings and not to fall behind is formed.

The results of the study on the effect of achievement goal orientations on academic engagement suggest that mastery approach but not mastery avoidance directly and positively predicts academic engagement and that performance approach and performance avoidance indirectly predict academic engagement (shown in Figure 1). The hypotheses including performance goal orientations indirectly predicting academic engagement and mastery approach goal

orientation directly predicting academic engagement are supported, but the hypothesis about the mastery avoidance orientation directly predicting academic engagement is denied. This is consistent with the results as before. Mastery avoidance has no direct predictive effect on academic engagement,³⁰ achievement goals driven externally (approach and avoidance) indirectly affect academic engagement.⁶⁷ The occurrence of such results may be related to the fact that the mastery approach allows for an arousal process focused on the activity itself with more adaptive and supportive learning processes, and mastery avoidance and performance avoidance allow for insufficient arousal focused on the task itself without more adaptive and supportive learning processes, mastery avoidance, and performance avoidance prevent individuals from maintaining high levels of engagement in the task.^{22,70} The performance approach still has excitatory arousal for the indirect consequences of completing the task, making it indirectly relevant to academic engagement through adaptive supportive learning processes. The first reason for the absence of mastery avoidance as a direct predictor of academic engagement may be related to the level of mastery approach in high school students. Mastery approach is significantly higher than mastery avoidance and dominant in high-school students, so the predictive role of mastery avoidance on the engagement got smaller. The second reason might derive from the convergent social mentality behind mastery avoidance and approach. The social mentality of Chinese high school students who want to master more knowledge, strive for superiority and avoid being disadvantaged in the future ranking in the college entrance examination for not mastering. So the predictive effect of the mastery avoidance on academic engagement becomes less prominent.

Mediating Role of Learning Strategies and Academic Self-Efficacy

As shown in Figure 1, approach goal orientations (mastery and performance) positively predict learning strategies and academic self-efficacy, and learning strategies and academic self-efficacy positively predict engagement; performance avoidance negatively predicts learning strategies and academic self-efficacy. From the above results, as for the second, third, and fourth set of hypotheses, except the hypothesis about mastery-avoidance goal orientation predicting the learning strategies and academic self-efficacy being denied, the other hypotheses are supported. These results are consistent with previous findings that approach goals are associated with adaptive outcomes and that avoidance goals are associated with maladaptive outcomes,⁷¹ which are consistent with mastery- and approach-oriented goal profiles being strongly adaptive and predicting less burnout, higher academic engagement, lower test anxiety,⁷² and less disengagement from coping learning strategies. The performance approach is typically positively associated with pride, hope, self-efficacy, and academic achievement. Performance avoidance is positively associated with academic difficulties, harmful emotions such as anxiety, despair, shame, disengaged coping,^{18,27,73–75} low persistence of learning, and less academic adjustment.²⁰

The above results imply that when students are oriented towards approach-goal orientations (mastery and performance), they would have expectations of obtaining improved competence or better performance than others and are willing to use effective metacognitive monitoring, cognitive strategies, and resource management strategies, thereby increasing the level of academic engagement. The effective use of learning strategies also allows them to gain a sense of autonomous certainty and control over their learning, thereby increasing academic self-efficacy, which enable them to engage in learning. A good state of academic engagement may breed multiple consequences, such as good learning outcomes, positive feedback on the likelihood of achieving goals, a greater sense of autonomy, experience of effective learning operations, and increased academic self-efficacy, the consequences further lead to more academic engagement. But when students are oriented by avoidant goals, they tend to avoid something negative, unwanted, and harmful, such as feelings of failure, negative evaluations and punishment, and are not willing to use systematic and in-depth metacognitive monitoring, cognitive strategies, and resource management strategies. This not only lead to lower levels of academic engagement but also to lower academic self-efficacy, which diminished the level of academic engagement again. Lower engagement in learning also further increases students' feelings of self-lost control and reduces self-efficacy and makes students more vulnerable in terms of psychological resources. These will further promote the formation of avoidant-goal orientation.

However, the hypothesis that mastery avoidance indirectly affects academic engagement through learning strategies and self-efficacy has not been proven. There are reasons for this. First, mastery approach and mastery avoidance may have the same meaning for students of high school in China. After all, the correlation between the mastery approach and

mastery avoidance ($r=0.631$) is higher, and mastery approach is significantly higher than mastery avoidance, so mastery avoidance did not have a direct and indirect effect on learning strategies, academic self-efficacy, and academic engagement. Second, mastery avoidance results from high activation on learning content derived from high activation on the fear of not mastering knowledge. Although the students try to get rid of fear experience by avoiding not mastering knowledge, what kind of knowledge should be avoided to not master is rather vague for high school students. This means that learning is not very attractive to students and that students do not initiatively use learning strategies, activate academic self-efficacy, and engage in academic activity. It is possible that there is other path between mastery avoidance and academic engagement. For example, some studies have found that mastery avoidance can predict academic engagement by seeking help from teachers.³⁰ However, whether academic engagement brought about by teacher help can further activate factors such as goal orientation, learning strategies, self-efficacy, and learning identity, and thus bring about the improvement of academic engagement, further research is needed.

Changes in Achievement Goal Orientation, Learning Strategies, and Academic Self-Efficacy Jointly Influence Academic Engagement Among Grades

After multiple groups of comparative analysis, the path of achievement goal orientation affecting academic engagement through learning strategies and academic self-efficacy is consistent across grades, but there are differences in local relationships, the results are shown in Table 4. These results fully support the fifth set of hypotheses. Grade differences in the paths of mastery approach and avoidance to learning strategies may be due to the different mental contexts and tasks experienced by different grades. In the first year, although the students have to face the challenge from adjustment from the end of middle school to the start of high school, they have more new hopes than in the other grades; in the third year, they have to experience the pressure from the college entrance exam, and they have more fear of mastery avoidance and performance avoidance, while sophomore year is at a smoother stage.⁷⁶ In terms of path differences, the influence of mastery approach on learning strategies was greater in the first and second years of high school than in the third year of high school, probably because mastery approach had a weaker guiding effect on third-year students. This reflects the fact that the guiding effect of achievement goal orientation is context dependent.⁷⁷ The grade-level differences in the pathway between mastery and learning strategies are due to the different levels of cognitive engagement in the three grades guided by mastery approach and mastery avoidance. The effective use of learning strategies leads to a successful and favorable learning experience that further enhances the sense of control and thus enjoys learning and engagement, and learning strategies are therefore a necessary condition for academic engagement. Therefore, it is not comprehensive to view learning strategies as cognitive engagement³⁰ and a valid representation of academic engagement.

Implications and Conclusions

Overall, the results of the study also further support that mastery approach is superior to performance approach. Mastery goals orientation are not only more relevant and more direct to human learning activities than performance goal orientations but also has a greater impact on learning strategies and self-efficacy, mastery goals is easier to make people engage in learning activities. When an individual is directly involved in the inquiry activity itself, the individual's own internal, expressive motivation, and self-worth are more likely to be realized. The individual is more likely to be connected with positive self-experience, the sense of self-control is more likely to be generated, eventually, he is more likely to be academic self-efficacy. It is more able to establish human being centered learning activities, and it is more able to establish in-depth and effective learning actions and self-controlled engagement. Under the circumstances, which advocate mastery goal orientations, it is easier to realize people's inner potential, inner value, and self-dignity itself. This indirectly supports humanism's ideas that human beings are born with inherent potential, value and dignity, the intrinsic, direct, and human goals are more motivating, while external controlling goals and external values do not play a constructive role in human activities.^{78,79} From the perspective of the direct and indirect effects of mastery and achievement goal orientation on learning engagement, it is necessary to research the psychological pathways in-depth between different dimensions of achievement goals on learning engagement, to further reveal the specific psychological processes of the impact of each achievement goal orientation on learning engagement.

From the comparison of the impact of two valences on learning strategies, self-efficacy and academic engagement, approach is more aggressive than avoidance, but approach is not necessarily more effective, it depends on the goal orientation. In terms of approach and avoidance valence, avoidance has negative or no effect on learning strategy, academic self-efficacy and academic engagement. Avoidance is that individuals have to do because of fearing some pain from body, mental, and psycho. The events that lead to pain include negative pressure, negative emotions, and even coercive power from the superego. These pain events lead to learning activities under stress coping, the narrowing and damaging effects of negative emotions on cognition, the pain also leads to conflict and tension in the structure of the self. The ego is not only concerned about learning but also not putting self in various unwanted consequences of being evaluated. Ego which is under the pain events and fear state is not conducive to learners' self-dedication and cognitive focus during learning. This theoretically indirectly supports psychoanalysis's views about ego action is powerless because of lack of hedonic id energy, and Higgins's regulatory focus theory about the psychological aftereffects of social self-preventive regulatory focus on people and academic engagement.^{80,81} It further illustrates that goal orientation activities which focus on results and social value depended on social comparison with others can drive people to engage in certain activities. However, compared with internal process value and self-comparison goal orientation activities, people who focus on results and social value are more likely cause the lower self-efficacy, which make people to concentrate and devote themselves to learning activities in less autonomy way. The further exploration is needed to explore the role of learning expectation emotions triggered by achievement goal orientation, as well as the pain and happiness caused by real-life learning actions. Of course, the psychological mechanism needs to be further studied in specific learning situations, such as the influence of cooperation self-efficacy, teacher teaching style, learning strategies, and classroom size on academic engagement.

From the above discussion, some conclusions are drawn as follows. First, although each achievement goal orientation dimension can affect learning engagement through the mediation of learning strategies and self-efficacy, the direct and indirect pathways of achievement goal orientation dimensions are not consistent. Although mastery goal orientations are more closely related to academic engagement than performance goal orientations, mastery-approach goal can not only directly but also indirectly orient academic engagement through learning strategy and self-efficacy in multiple and chain mediating way. Second, the adaptive direction and magnitude of the impact path of achievement goal orientation dimensions on learning engagement through mediating learning strategies and self-efficacy are not consistent. Both performance approach goal and performance avoidant goal can indirectly affect academic engagement through learning strategy and self-efficacy in multiple and chain mediating way, however, performance approach is positive for learning strategies and self-efficacy orientation, while performance avoidant is negative, which means that performance avoidance is non-adaptive and destructive in learning. Third, the academic year stage has a partial impact on various achievement goal orientation dimensions affecting learning engagement through the mediating effect of learning strategies and self-efficacy, but there is no overall structural impact. The path configurations of achievement goal orientation, learning strategies, and academic self-efficacy on academic engagement were consistent across grades, but the local relationships were quantitatively different. The results not only illustrate the direct and indirect, positive, and negative effects of achievement goal orientations on learning strategies, academic self-efficacy, and academic engagement due to differences in achievement goal orientation and valence orientation, the current study also validate the claims of achievement goal orientation theory and social cognitive theory regarding the relationship between achievement goal orientation, learning strategies, and academic self-efficacy and academic engagement. These conclusions also indicate that the specific mechanisms of the impact of various achievement goal orientation dimensions on learning engagement are not the same, the further exploration are needed.

The current study also has some limitations. First, the variables were all derived from students' self-reports. The future studies need to reduce measurement bias by evaluating students' academic engagement levels through multi-subject reports, such as classroom observations and in-depth interviews from parents' and teachers' perspectives. Second, although the sample size of this study is large, its representativeness is limited. The subjects are only selected in the east-central part of the Inner Mongolia Autonomous Region, China; the follow-up study can examine students from different regions and backgrounds to increase the representativeness of the sample and test the results of this study. Finally, this study is a cross-sectional study and lacks a longitudinal investigation. A follow-up study can be used to further clarify

whether the mechanisms of achievement goal orientation, learning strategies, and academic self-efficacy on academic engagement change over time. From the research conceptualization, achievement goal orientation can also be influenced by attribution styles; motivational self-talk strategies, teacher support, and perceived school climate affect academic engagement. Especially with the rise of new teaching forms such as flipped classrooms and online teaching, the relationship between students' learning strategies, learning goals, self-efficacy in flipped classrooms, and academic engagement is an emerging research field.⁸² Therefore, subsequent research on the mechanisms of achievement goal orientation on academic engagement can be explored from multiple perspectives and extended to contexts such as classroom with multimedia scenarios.

Ethics Approval and Informed Consent

These studies involving human participants have been approved by the ethics committee at School of Psychology, Inner Mongolia Normal University. These studies were conducted in accordance with the Declaration of Helsinki. Informed consent was obtained from all individual participants in this study. We have obtained informed consent information from parents or legal guardians of study participants who are below the age of consent.

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Author Contributions

Jianjun Zhong played the leading role in this research, for example, giving ideas, constructing conceptions, designing research blueprint, analyzing data, getting new findings, and writing the manuscript. Juan Wen carried out lots of works, for example, research design, data analysis and writing. Kuan Li analyzed the data and wrote the research design part. All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work. Jianjun Zhong and Juan Wen are the co-first authors for this study.

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Disclosure

The authors report no conflicts of interest in this work.

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