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Structural model of intelligence beliefs, motivational beliefs, academic self-handicapping and academic adjustment in Chinese undergraduate students

Yu Han^{1*}

Abstract

Background Academic adjustment is crucial for students' success and well-being, yet the factors influencing this process must be more adequately understood. Although prior research has explored the impact of Intelligence and motivational beliefs on academic outcomes, there is a need to clarify how these beliefs interact to influence academic adjustment. Specifically, the existing literature needs a comprehensive model that integrates intelligence beliefs, motivational beliefs, and academic self-efficacy and examines their combined effect on academic adjustment.

Objectives This research aims to develop and analyze a model that explains the relationships among intelligence beliefs (fixed and growth mindsets), motivational beliefs (including self-efficacy and intrinsic value) and test anxiety in predicting academic adjustment. This study also seeks to investigate the mediating role of academic self-efficacy in these associations, providing a deeper understanding of the underlying mechanisms that contribute to students' academic adaptation.

Method The research employed a correlational methodology, targeting male and female undergraduate students at Inner Mongolia Medical University during the 2021 academic year. The statistical population comprised students from various departments, and a convenience sampling approach was utilized. Data collection involved 384 participants who completed questionnaires, including the Academic Adjustment Questionnaire, Intelligence Beliefs Questionnaire, Motivational Beliefs Questionnaire, and Academic Self-Efficacy Questionnaire.

Results The findings revealed a favourable fit between the proposed model and the collected data. Furthermore, through a comprehensive direct and indirect effects analysis, it was evident that academic self-efficacy mediated the relationships among intelligence beliefs (both inherent and incremental), self-efficacy, intrinsic value, test anxiety, and academic adjustment. These results contribute to a nuanced understanding of the factors influencing academic adjustment among undergraduate students.

Conclusions and implications In conclusion, this research underscores the pivotal role of academic self-efficacy as a mediator in the nexus between intelligence beliefs (both inherent and incremental) and academic adjustment. The study advocates for heightened attention to these constructs in educational planning. It emphasizes the need for educational interventions that foster positive Intelligence and motivational beliefs and mitigate test anxiety

*Correspondence:

Yu Han

yuhan4890@outlook.com

Full list of author information is available at the end of the article



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to enhance academic self-efficacy and promote successful academic adjustment. The implications of these findings extend to educators, counsellors, and policymakers involved in shaping the educational experiences of undergraduate students.

Keywords Motivational beliefs, Intelligence beliefs, Academic self-efficacy, Academic adjustment, Undergraduate students

Introduction

The issue of academic adaptation has become increasingly pressing, with significant implications for student retention and well-being. Worldwide, millions of students struggle to cope with the demands of their educational environments, leading to high dropout rates. In China alone, many students leave school each year due to their inability to adapt, a problem exacerbated by intense academic pressure and stress. Research indicates that a considerable proportion of students experience heightened stress levels during their studies, which affects not only their academic performance but also their mental health.

It is crucial to understand the factors that influence students' ability to adapt to their educational environments. Educational adaptation involves behavioural and psychological changes as students strive to align themselves with their academic settings, meet performance expectations, and fulfil their learning needs [1–5]. This concept encompasses various aspects, including motivation, performance, and overall adjustment to the school environment [6]. Among the many factors influencing educational adaptation, intelligence beliefs have garnered significant attention. Dweck's theory [7] posits that beliefs about the nature of Intelligence play a pivotal role in how students perceive success and failure, which, in turn, affects their ability to cope with educational challenges.

Dweck [7] introduced a social cognitive approach to understanding human Intelligence by examining implicit theories. These theories suggest that individuals conceptualize Intelligence through an incremental or entity belief framework. Those with incremental beliefs view Intelligence as malleable and improvable through effort, while those with entity beliefs see it as fixed and unchangeable [8–10]. These differing perspectives can significantly affect cognition, emotion, and behaviour in various contexts [11]. The role of intelligence beliefs extends beyond academic success to include overall well-being and adaptation. For instance, entity theorists may interpret failure as a reflection of inherent inadequacy, negatively impacting their ability to adapt.

In contrast, those with incremental beliefs are more likely to exhibit resilience, viewing failure as an opportunity for growth [13]. This area remains underdeveloped despite some research exploring the relationship between

intelligence beliefs and academic adaptation, which still needs to be developed. Existing studies have linked incremental intelligence beliefs with positive educational outcomes [14–16].

Motivational challenges are another critical factor in academic adaptation. Students frequently encounter tasks they perceive as uninteresting, burdensome, or complex. Persistence in the face of these challenges is crucial for learning and academic success [11, 17, 18]. Learning motivation, which includes students' expectations of success and their value on task performance, is vital for academic adaptation [18]. Test anxiety, a significant emotional component of motivational beliefs, is critical in academic adaptation. Students with high test anxiety often display lower self-efficacy and fewer self-regulatory learning strategies compared to their less anxious peers [19–23].

Research has investigated the relationship between various dimensions of motivational beliefs and academic adaptation. Studies have shown that self-efficacy, task value, and emotional responses to school tasks are strongly associated with adaptation [23–26]. Academic self-efficacy, in particular, emerges as a critical mediator between intelligence beliefs, motivational beliefs, and academic adaptation. It acts as a protective factor, enabling students to navigate educational challenges and recover from failures. While previous studies have identified direct relationships between these variables, the mediating role of academic self-efficacy in the connections between intelligence beliefs, motivational beliefs, and academic adaptation still needs to be explored. This study aims to propose and test a comprehensive model, positing that academic self-efficacy mediates the relationships between intelligence beliefs and academic adaptation, as well as between motivational beliefs (self-efficacy, task value, and test anxiety) and academic adaptation. By examining these relationships, the study aims to illuminate the complex dynamics of academic adaptation in educational settings.

This study proposes a comprehensive model that integrates intelligence beliefs, motivational beliefs, and academic self-efficacy to explain their collective impact on academic adaptation. Specifically, the model suggests that academic self-efficacy serves as a crucial mediator in the relationship between intelligence

beliefs (incremental and entity) and academic adaptation, as well as between motivational beliefs (self-efficacy, intrinsic value, and test anxiety) and academic adaptation.

The holistic approach of this study to understanding academic adaptation sets this model apart from existing research. While previous studies have explored the direct effects of Intelligence and motivational beliefs on educational outcomes, they have often overlooked the interconnectedness of these factors and the pivotal role of academic self-efficacy. By positioning academic self-efficacy as a central mediator, this model offers a more nuanced understanding of how these beliefs influence students' ability to adapt to educational challenges. This contribution fills a significant gap in the literature, providing insights that could inform interventions to improve academic adaptation and reduce dropout rates. This research seeks to demonstrate a pattern of relationships to answer the following questions:

1. Does the proposed theoretical model have acceptable psychometrics?
2. Does academic self-efficacy play an intermediary role in the relationship between dimensions of intelligence beliefs and academic adaptation?
3. Does academic self-efficacy play an intermediary role in the relationship between dimensions of motivational beliefs and academic adaptation?

Literature review

Academic adaptation: definition and importance

Adaptation initially derived from the field of biology, with Charles Darwin first introducing it in his theory of evolution. Over time, the concept has been applied to other sciences, including sociology and psychology [1]. Adaptation, as a psychological process, enables individuals to respond to environmental demands [2]. Among the various forms of adaptation, academic adaptation has emerged as a persistent challenge in education. Researchers have conducted numerous studies to determine the factors affecting students' adaptation to the school environment. Educational adaptation is a complex and comprehensive concept [3]. It encompasses behavioural and psychological changes, where individuals attempt to align themselves with their new academic environment, succeed in meeting educational demands, and satisfy their learning needs [4]. In essence, educational adaptation refers to the degree of an individual's alignment with educational contexts, including motivation, performance, and adjustment to the school environment [5].

The role of intelligence beliefs in academic adaptation

Among the factors influencing educational adaptation, intelligence beliefs have received considerable attention. Dweck [7] proposed that intelligence beliefs affect how individuals interpret successes and failures and influence the establishment of progressive goals, ultimately impacting educational adaptation. Dweck's motivational model aimed to understand the psychological resources that allow students to cope with persistent academic challenges [7–11]. Her model suggests that different beliefs about the nature of intelligence shape individuals' responses to challenging tasks [10–12].

These beliefs are discussed within the framework of the implicit theory of Intelligence. Students with an entity theory of Intelligence view Intelligence as a fixed trait, believing they possess a certain amount that cannot change. This perspective can lead to concerns about their level of Intelligence, affecting their academic adaptation negatively. Conversely, students with an incremental theory of Intelligence see Intelligence as malleable, believing it can grow with effort [8–11]. While initially examined in the context of academic success, intelligence beliefs also impact broader well-being and adaptation outcomes [13].

Research in this area is still developing, with few studies directly linking intelligence beliefs and academic adaptation. Martin [14] found a significant positive relationship between incremental intelligence beliefs and academic adaptation. King [15] explored the consequences of intelligence beliefs, showing that entity beliefs are negatively associated with self-esteem and progress. In contrast, incremental beliefs are positively linked to emotions, progress, and various self-esteem measures. Similarly, Bernardo [16] reported a positive relationship between incremental intelligence beliefs and adaptive outcomes.

Motivational beliefs, academic self-efficacy, and academic adaptation

Motivational challenges are another critical factor influencing academic adaptation. Students often encounter tasks they perceive as unimportant, tiresome, or complex. Extensive evidence indicates that students' ability to confront and persist through these challenges significantly impacts their learning and success [11, 17, 18]. Wigfield and Eccles [18] define learning motivation as a combination of students' expectations for success and the value they place on task performance. Emotional beliefs, such as test anxiety, also significantly influence academic adaptation. Students with high levels of test anxiety typically exhibit lower self-efficacy and fewer self-regulatory learning strategies compared to their less anxious peers [19, 20].

Pekrun [20] introduced three motivational components in a social-cognitive model: expectancy (self-efficacy beliefs), value (importance and interest in tasks), and emotional responses (including test anxiety) to school tasks [21]. Test anxiety, as an emotional component, has been shown to influence academic achievement, with studies highlighting a negative relationship between test anxiety and student adaptation [22, 23]. Conversely, research by Zhai and Coleman [24] found a positive relationship between self-efficacy and academic adaptation. At the same time, Cazan [25] identified self-regulated learning strategies and the value component as predictors of positive academic adaptation.

Academic self-efficacy, which relates to individuals’ beliefs about their capabilities to manage and succeed in educational tasks, emerges as a pivotal mediator in the relationship between intelligence beliefs, motivational beliefs, and academic adaptation. Self-efficacy is a protective mechanism that helps students constructively interpret failures and maintain their self-confidence [27–35]. Schools and classrooms offer environments where academic self-efficacy behaviours are frequently utilized, assisting students to navigate tasks that challenge their abilities [36]. Covington [37] highlighted the role of academic self-efficacy in preserving self-worth, particularly in educational settings where students’ skills and Intelligence are constantly assessed.

Self-efficacy can manifest in various forms, such as behavioural or claimed self-handicapping [38–41]. These strategies are employed by students to protect their self-worth, especially in situations where their self-perception is threatened. Empirical evidence supports the conceptual differences in self-handicapping behaviours, which are influenced by the specific context and motivational factors. In line with this literature

review, the following conceptual model can be stipulated (Fig. 1).

Methodology

This research falls into the category of non-experimental correlational studies, where attempts are made to examine relationships through non-experimental methods. This type of research focuses on assessing associations between existing variables using various statistical techniques. This study employed a structural equation modelling approach to evaluate the relationships between the measured variables in the proposed model. The sample for this study consisted of 384 undergraduate students at Inner Mongolia Medical University, Hohhot, China, during the 2021 academic year. The participants were aged between 20 and 26, with 45% of them in the 20–22 age range (typically early-year students), 35% aged 23–24 (mid-level students), and 20% aged 25–26 (senior students nearing the end of their studies). Regarding gender distribution, 60% of the participants were female, reflecting the higher representation of women in health sciences programs, while 40% were male. Regarding academic programs, 30% of the students were enrolled in medicine, the university’s most extensive and central program. Nursing students comprised 25% of the sample, while 20% were studying pharmacy, 15% were in public health, and 10% were pursuing biomedical engineering. The distribution across the years of study showed that 20% of the participants were first-year students, 25% were second-year students, 30% were in their third year, and 25% were final-year students. Ethnically, the majority of the students (70%) were Han Chinese, consistent with the national demographic, while 20% were Mongol, reflecting the regional ethnic composition of Inner Mongolia. The remaining 10% belonged to other ethnic minorities. Regarding religiosity, 60% of the students identified as non-religious, aligning with broader national trends

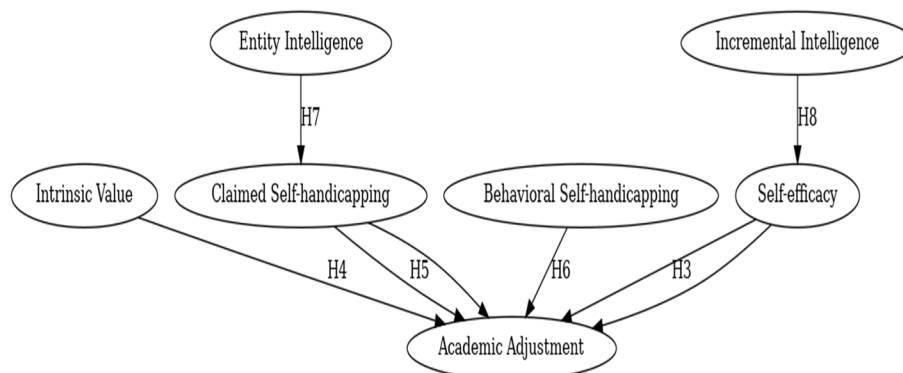


Fig. 1 Structural models of academic adjustment, intelligence beliefs, motivational beliefs, and academic self-handicapping variables

in China. A quarter of the sample (25%) practised Buddhism, 10% followed traditional Chinese religious practices, and 5% adhered to other religious beliefs.

Research instruments

Academic adaptation questionnaire

The questionnaire developed by Baker and Siry [42] was utilized to measure academic adaptation. This questionnaire comprises 67 items, which assess academic adaptation across four sub-scales: academic adaptation (24 items), social adaptation (20 items), emotional adaptation (15 items), and school attachment (8 items). Items were rated on a five-point Likert scale ranging from "completely disagree" to "completely agree." In this study, the academic adaptation sub-scale was used. The Cronbach's alpha reliability coefficient for the questionnaire in this research was 0.79, indicating good reliability.

Intelligence beliefs questionnaire

Dupeyrat and Marian [43] developed the questionnaire to measure intelligence beliefs. This questionnaire consists of nine items that assess two components of intelligence beliefs, entity beliefs, and incremental beliefs, using a five-point Likert scale. The reliability coefficient (Cronbach's alpha) for the questionnaire in this study was 0.71 for entity beliefs and 0.76 for incremental beliefs, indicating good reliability.

Motivational beliefs questionnaire

The Motivated Strategies for Learning Questionnaire (MSLQ) by Pintrich and DeGroot [44] was used to measure motivational beliefs. This questionnaire contains 47 items and measures two main components: motivational beliefs (self-efficacy, intrinsic values, task value, control of learning beliefs) and self-regulated learning strategies (cognitive strategies and self-regulation). This study employed sub-scales related to motivational beliefs, including self-efficacy, intrinsic value, and test anxiety. The Cronbach's alpha reliability coefficients for the questionnaire in this research were 0.87 for self-efficacy, 0.89 for inherent goal orientation, and 0.75 for test anxiety, indicating good reliability.

Academic self-handicapping questionnaire

Jones and Radovilsky's [45] academic self-handicapping questionnaire was used to measure academic self-efficacy. This questionnaire consists of 25 items, each scored on a five-point Likert scale ranging from "completely disagree" (score 1) to "completely agree" (score 5). It assesses students' utilization of self-regulated learning strategies and reflects how much students employ them. The reliability of this questionnaire was assessed using Cronbach's alpha coefficient, yielding values of 0.78 and 0.80 for the

declarative and behavioural dimensions, respectively. Additionally, the validity of the questionnaire was confirmed through exploratory factor analysis. The exploratory factor analysis indicated that 23 items from the scale loaded onto three factors: negative mood, effort, and "excuse-making. According to the theory, the sum of negative mood scores inversely correlates with effort scores, representing behavioural self-efficacy. Furthermore, the sum of negative mood scores, combined with "excuse-making," represents declarative self-efficacy. This study demonstrates the instrument's appropriate reliability and validity for measuring students' academic self-efficacy.

Procedure

First, permission was obtained to visit schools and administer questionnaires from multiple educational districts in Tehran. Individuals administered the questionnaires individually by visiting schools and explaining the research objectives to the students, assuring them about privacy and confidentiality, and obtaining informed consent. After data extraction, the data were analyzed using structural equation modelling. Additionally, measurement model validation was conducted using confirmatory factor analysis with LISREL software version 8.8. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were extracted using SPSS software version 25. Out of 375 questionnaires, 343 were entered into the software.

Findings

Analysis of demographic information showed that 172 respondents (45.9%) were female, and 203 respondents (54.1%) were male. In terms of age distribution, the results indicated that 13 respondents (3.5%) were 15 years old, 119 respondents (31.7%) were 16 years old, 163 respondents (43.4%) were 17 years old, and 48 respondents (12.8%) were 18 years old. The normality assumption, crucial for parametric analyses, was assessed using

Table 1 Mean, standard deviation, skewness, and kurtosis of research variables

Variable	Mean	SD	Skewness	Kurtosis
Entity intelligence	12.14	2.98	0.08	-0.77
Incremental Intelligence	18.27	4.25	-0.53	-0.50
Self-efficacy	33.81	5.45	-0.04	0.12
Intrinsic value	14.05	3.32	-0.37	-0.55
Claimed self-handicapping	58.52	14.01	-0.39	-0.55
Behavioural self-handicapping	50.03	11.56	0.10	-0.38
Academic adjustment	97.07	16.55	0.33	-0.11

Table 2 Pearson correlation coefficients between research variables

Variable	1	2	3	4	5	6	7	8
1. Entity Intelligence	1							
2. Incremental Intelligence	-0.21**	1						
3. Self-efficacy	-0.22**	0.28**	1					
4. Intrinsic Value	-0.21**	0.26**	0.58**	1				
5. Claimed Self-Handicapping	0.36**	-0.30**	-0.30**	0.38**	0.60**	1		
6. Behavioral Self-Handicapping	0.35**	-0.32**	-0.32**	-0.34**	0.59**	0.82**	1	
7. Academic Adjustment	0.27**	0.27**	0.28**	0.29**	0.24**	0.22**	0.25**	1

** $p < 0.01$ for all correlations

Table 3 Model fit indices

Fit Index	Value	Interpretation
Root Mean Square Error of Approximation (RMSEA)	0.062	Acceptable fit (below 0.08)
Normed Fit Index (NFI)	0.92	Good fit (above 0.90)
Comparative Fit Index (CFI)	0.93	Good fit (above 0.90)
Goodness of Fit Index (GFI)	0.91	Good fit (above 0.90)
Chi-square/degree of freedom (χ^2/df)	3.06	Acceptable (values below five are considered reasonable)

skewness and kurtosis statistics. The results of this test for the variables in this study are presented in Table 1.

As shown in the above Table, skewness and kurtosis of the scores of all variables are between -2 and +2, suggesting that the scores are normally distributed. Therefore, the researchers were on the safer ground to use parametric statistical tests. The correlation matrix is presented in Table 2.

As Table 2 shows, there is a significant correlation between the components of beliefs about Intelligence, motivational beliefs, academic self-handicapping, and academic adjustment. All correlations are essential at the

0.01 level. Therefore, the linear correlation between all variables is confirmed (Table 3).

Model fit indices

In SEM, model fit indices help assess how well the theoretical model matches the observed data. Table 3 provides the fit indices.

The model shows an acceptable to good fit, indicating that the data support the hypothesized relationships among variables. The direct and indirect effects of the Standardized Estimate (β) and Non-standardized Estimate (B) were estimated, and the results are presented in (Figs. 2 & 3) and Table 4.

For the direct effects, Entity Intelligence had a significant positive impact on Academic Adjustment, with a standardized coefficient of $\beta = 0.27$, $B = 0.30$, and $p = 0.01$, indicating that higher levels of entity intelligence are associated with better academic adjustment (H1). Similarly, the direct effect of Incremental Intelligence on Academic Adjustment was also significant ($\beta = 0.27$, $B = 0.29$, $p = 0.01$), suggesting that individuals with stronger incremental intelligence beliefs experience better academic adjustment (H2). Self-efficacy also demonstrated a significant positive effect on Academic Adjustment ($\beta = 0.28$, $B = 0.32$, $p = 0.01$), meaning that

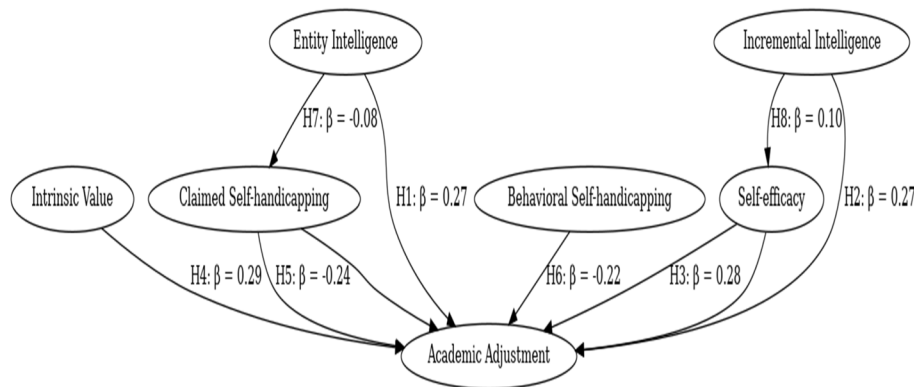


Fig. 2 Empirical structural model (path) based on standard coefficients

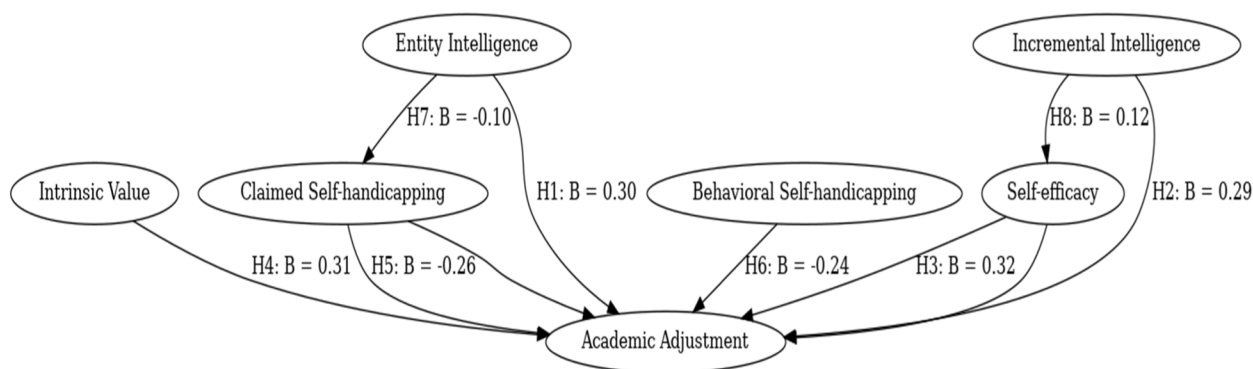


Fig. 3 Empirical structural model (path) based on non-standard coefficients

Table 4 Hypotheses testing results

Hypothesis	Path	Standardized Estimate (β)	Non-standardized Estimate (B)	p	Supported?
H1	Entity Intelligence \rightarrow Academic Adjustment	0.27	0.30	0.01	Yes
H2	Incremental Intelligence \rightarrow Academic Adjustment	0.27	0.29	0.01	Yes
H3	Self-efficacy \rightarrow Academic Adjustment	0.28	0.32	0.01	Yes
H4	Intrinsic Value \rightarrow Academic Adjustment	0.29	0.31	0.01	Yes
H5	Claimed Self-handicapping \rightarrow Academic Adjustment	-0.24	-0.26	0.01	Yes
H6	Behavioral Self-handicapping \rightarrow Academic Adjustment	-0.22	-0.24	0.01	Yes
H7	Entity Intelligence \rightarrow Self-handicapping \rightarrow Academic Adjustment	-0.08	-0.10	0.05	Yes
H8	Incremental Intelligence \rightarrow Self-efficacy \rightarrow Academic Adjustment	0.10	0.12	0.05	Yes

higher levels of self-efficacy are associated with more significant academic adjustment (H3). The direct effect of Intrinsic Value on Academic Adjustment was significant ($\beta=0.29$, $B=0.31$, $p=0.01$), indicating that students who value their tasks intrinsically exhibit better adjustment academically (H4).

On the other hand, Claimed Self-handicapping negatively impacted Academic Adjustment, with a significant direct effect of $\beta=-0.24$, $B=-0.26$, $p=0.01$, indicating that students who engage in claimed self-handicapping behaviours experience lower academic adjustment (H5). Similarly, the direct effect of Behavioral Self-handicapping on Academic Adjustment was significant and negative ($\beta=-0.22$, $B=-0.24$, $p=0.01$), suggesting that engaging in behavioural self-handicapping also leads to poorer academic adjustment (H6).

Regarding the indirect effects, Entity Intelligence had a significant negative indirect effect on Academic Adjustment through Self-handicapping ($\beta=-0.08$, $B=-0.10$, $p=0.05$), implying that self-handicapping partially mediates the relationship between entity intelligence and academic adjustment, leading to worse outcomes (H7). Furthermore, Incremental Intelligence had a significant positive indirect effect on Academic Adjustment through Self-efficacy ($\beta=0.10$, $B=0.12$, $p=0.05$), indicating that

self-efficacy is a mediator that strengthens the positive relationship between incremental intelligence and academic adjustment (H8). In summary, the findings suggest that beliefs about Intelligence, self-efficacy, intrinsic value, and self-handicapping behaviours play crucial roles in influencing academic adjustment, directly and indirectly.

Discussion

The present study addresses an important theoretical and practical issue in educational psychology: understanding how intelligence beliefs and motivational factors impact academic adaptation. This is particularly meaningful because academic adaptation is critical to student success in higher education. The findings of the study, based on correlational data, reveal that academic adaptation is associated with both beliefs about Intelligence and motivational beliefs, with academic self-efficacy playing a critical mediating role. The research adds to the growing body of evidence on how these psychological constructs interact and influence students' academic behaviour and outcomes, thus enriching our understanding of student adaptation in academic contexts [6, 14, 15].

The findings demonstrate that entity intelligence beliefs are negatively associated with academic

adaptation, while incremental intelligence beliefs are positively associated with it. This aligns with existing research indicating that students who view Intelligence as fixed (entity beliefs) may be less likely to persist and adapt academically. In contrast, those with a growth mindset (incremental beliefs) tend to show better academic outcomes [14]. Additionally, the role of academic self-efficacy as a mediator is significant, as it helps explain how intelligence beliefs influence academic adaptation. Individuals with incremental intelligence beliefs exhibit higher self-efficacy, which, in turn, is linked to more significant academic adjustment [23, 25, 29].

The results also highlight the detrimental effects of self-handicapping behaviours, often associated with entity intelligence beliefs. Students who engage in self-handicapping, such as procrastination or making excuses, demonstrate lower academic adaptation. This reinforces previous findings that entity intelligence beliefs foster avoidance behaviours, undermining academic success [46, 47]. Understanding the psychological mechanisms behind self-handicapping is crucial, as these behaviours hinder personal growth and educational adjustment [48].

Furthermore, the findings support Bandura's theory of self-efficacy, which posits that individuals with solid self-efficacy beliefs exert more significant effort and persistence in tasks, ultimately leading to better performance. Conversely, individuals who doubt their abilities may engage in self-handicapping to protect their self-esteem [34]. Self-handicapping strategies allow students to externalize failure and internalize success, temporarily protecting their self-worth but ultimately hindering long-term academic adaptation [35]. In line with Covington's self-worth theory, excessive effort coupled with failure can damage self-worth, particularly for students who exhibit self-handicapping tendencies [37].

In education, self-efficacy is critical in students' behaviour and performance. Classrooms provide environments where students' abilities and Intelligence are constantly judged, and students who employ self-handicapping strategies to avoid failure often struggle to adapt academically in the long term. These behaviours initially protect self-worth but eventually damage self-efficacy and academic success [36, 49].

Intrinsic task value, or the personal importance and interest students place on tasks, is another crucial factor influencing academic adaptation. When students employ self-handicapping strategies, they often undermine their ability to value tasks intrinsically, complicating their academic adjustment. Task avoidance, negative expectations, and external attributions, all associated with self-handicapping, contribute to poorer educational outcomes [50, 51].

Moreover, the findings confirm that test anxiety is negatively associated with academic adaptation, further contributing to self-handicapping behaviours and reduced academic performance. Test anxiety, which impairs working memory and concentration, creates a negative feedback loop where poor performance reinforces self-handicapping and reduces academic adaptation over time [50, 51]. The study's findings also align with research highlighting the role of executive functions in cognitive performance, particularly in tasks requiring reasoning, problem-solving, and decision-making. These mental processes, which rely on both intuitive (Type 1) and analytical (Type 2) thinking, align with implicit beliefs about Intelligence, further affecting academic outcomes [52, 53].

In conclusion, this study contributes to the literature by demonstrating the critical role of intelligence beliefs, motivational beliefs, and self-efficacy in academic adaptation. The research adds a nuanced understanding of how students' psychological frameworks impact their academic success by emphasising the associations between these constructs and avoiding predictive language. This knowledge has practical implications for educators, who can design interventions that promote incremental intelligence beliefs and self-efficacy while discouraging self-handicapping behaviours, ultimately supporting students' academic adjustment and success [12, 54].

Despite its merits, this study has several limitations. First, the cross-sectional design limits the ability to conclude the directionality or causality of the observed relationships. While associations between intelligence beliefs, motivational beliefs, and academic adjustment were established, longitudinal data would be necessary to confirm the temporal sequence of these variables [55].

Second, relying on self-reported measures introduces the potential for social desirability bias, where participants might overestimate or underestimate their behaviours or beliefs. Future studies could complement self-reports with objective measures of academic performance or other behavioural indicators of self-handicapping. Third, convenience sampling from a single university in Inner Mongolia, China, limits the generalizability of the findings to different regions or cultural contexts. The sample may not fully represent the diversity of Chinese undergraduate students, and results may differ in other educational or cultural settings.

The study did not account for other psychological or environmental factors, such as peer influence, family background, or institutional support, that might also contribute to academic adjustment. Including such variables could provide a more holistic view of the factors impacting students' academic success. Finally, although the study focuses on Chinese undergraduate students, it

would be beneficial to examine how these relationships manifest across different academic disciplines or levels of study (e.g., postgraduate students), as the dynamics of self-handicapping and motivational beliefs may vary with educational experience.

Conclusions and implications

The role of intrinsic valuing in predicting academic adaptation is significant. When students genuinely value a task or subject, they adapt well to their academic environment. Conversely, using self-handicapping strategies to avoid tasks diminishes intrinsic valuing and hinders academic adaptation. Therefore, fostering intrinsic motivation is crucial for students' academic success. Self-handicapping behaviours, such as task avoidance, expecting failure, and making excuses, negatively affect academic adaptation. These behaviours create a negative cycle, reducing academic performance and poorer adaptation. Recognizing and addressing self-handicapping tendencies is essential to help students develop more adaptive learning strategies. It can also be concluded that the interplay between self-handicapping, intrinsic valuing, and test anxiety is complex. Test anxiety exacerbates the negative impact of self-handicapping, further hindering academic adaptation. This complex relationship underscores the need for comprehensive strategies to address these factors.

This study has different implications. First, educators should design interventions that promote the intrinsic value of academic tasks and subjects. Fostering a sense of importance and interest in learning can enhance students' adaptability and motivation. Moreover, schools and colleges should implement strategies to manage test anxiety effectively. This could involve providing students with stress management techniques, counselling services, or creating a supportive testing environment. In addition, recognizing and addressing self-handicapping behaviours is crucial. Schools can offer counselling or workshops to help students overcome these self-sabotaging tendencies and develop more adaptive learning strategies.

Furthermore, schools should adopt a long-term perspective on academic adaptation. Encouraging students to focus on intrinsic valuing and long-term goals can improve their educational prospects and overall well-being.

Moreover, parents and teachers play vital roles in fostering intrinsic valuing and managing test anxiety. They should communicate with students about the importance of learning, provide emotional support, and collaborate to create a positive learning environment.

In conclusion, nurturing intrinsic motivation and addressing self-handicapping behaviours are essential for promoting academic adaptation. By implementing

appropriate strategies, educational institutions and stakeholders can contribute to students' overall success and well-being in their academic journeys. Despite the merits, this study needs some limitations. Therefore, researchers should continue to explore the intricate relationships between intrinsic valuing, self-handicapping, and academic adaptation. Understanding these dynamics more comprehensively can lead to more effective interventions and support systems.

This study contributes significantly to the existing literature by exploring the relationships between intelligence beliefs, motivational beliefs, self-handicapping behaviours, and academic adjustment, specifically in the context of Chinese undergraduate students. Integrating intelligence and motivational beliefs provides a more comprehensive understanding of the factors influencing academic adjustment. Another strength lies in including academic self-handicapping as a mediator, which offers a novel perspective on how avoidance behaviours can hinder academic success. Additionally, Structural Equation Modeling (SEM) allows for a sophisticated examination of direct and indirect effects, providing insight into the complex interplay of these psychological constructs. The study's findings also have practical implications for educational interventions, which could be designed to promote growth-oriented beliefs and reduce self-handicapping behaviours, thus fostering better academic adaptation.

The study has implications for other researchers interested in this field. First, future research should employ a longitudinal design to address the limitation of the cross-sectional approach used in this study. A longitudinal study would help establish the temporal sequence and causality of the relationships between intelligence beliefs, motivational beliefs, and academic adjustment, providing a more robust understanding of how these variables interact and influence one another over time.

Second, to mitigate the potential for social desirability bias introduced by relying on self-reported measures, future studies could include objective measures of academic performance, such as grades or test scores, and behavioral indicators of self-handicapping, like attendance records or assignment completion rates. Combining self-reports with these objective metrics would enhance the reliability and validity of the findings.

Third, given that the study was based on convenience sampling from a single university in Inner Mongolia, China, there is a limitation in the generalizability of the findings to other regions or cultural contexts. Future research should aim to include more diverse samples from multiple universities and different regions within China, as well as from other countries, to determine

whether the observed relationships hold across various educational, cultural, and socio-economic contexts.

Fourth, future studies should incorporate additional psychological and environmental factors, such as peer influence, family background, and institutional support, which were not accounted for in the current study. Including these variables could provide a more holistic view of the factors influencing students' academic adjustment and offer insights into broader determinants of academic success.

Fifth, it would be valuable to examine how these relationships manifest across different academic disciplines or levels of study, such as postgraduate or high school students, as the dynamics of self-handicapping and motivational beliefs may vary with educational experience. This would help identify any discipline-specific or level-specific trends in academic adjustment.

Finally, to better understand the cultural specificity of the findings, future research should consider conducting comparative studies involving students from different countries or cultural backgrounds. Such studies would help clarify whether the relationships observed in this study are universally applicable or specific to certain cultural contexts, thereby enhancing the global relevance of the findings.

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Authors' contributions

Yu Han conceived and designed the concept and wrote the paper, and Yu Han collected the data. Yu Han wrote the manuscript. Yu Han reviewed the manuscript.

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Data availability

The data will be available upon request from the corresponding author (Corresponding author: email: zhangyating198911@163.com).

Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

The Institutional Review Board of Inner Mongolia Medical University, Hohhot, reviewed and approved the studies involving human participants. (the ethical letter number was 202356/2023). The study involved no patients. The participants provided written informed consent to participate in this study. All experiments were performed by relevant guidelines and regulations.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

¹School of Humanities Education, Inner Mongolia Medical University, Hohhot 010000, China.

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