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Exploring the effect of career planning on learning engagement: evidence from vocational and applied undergraduates in China

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Article

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Abstract

Career planning not only bears upon the quality of students' professional development after graduation but may also profoundly influence their level of learning engagement while still at university; the relationship between career planning and learning engagement is therefore worthy of further exploration. Based on 2,100 valid questionnaires, this study employed multiple linear regression and mediation analysis to investigate the effect of career planning on learning engagement and its underlying mechanisms. The results show that career planning significantly and positively predicts overall learning engagement, as well as its three dimensions, cognitive, behavioral, and practical, with the strongest effect on cognitive engagement. Among the three dimensions of career planning, career planning execution exerts the most substantial influence on learning engagement. In addition, professional identity and academic self-efficacy play partial mediating roles in the relationship between career planning and learning engagement, with academic self-efficacy showing a relatively stronger effect. The interaction between career planning and undergraduate type is not statistically significant, indicating that the positive effect of career planning on learning engagement is generally consistent across vocational undergraduate and applied undergraduate students. These findings suggest that career planning is not only a preparatory process for future career development but also an important factor shaping students' current learning engagement. Universities should strengthen career planning education and enhance students' professional identity and academic self-efficacy in order to promote higher levels of learning engagement.

1. Introduction

As higher education continues to develop, the question of how university students can effectively bridge their current learning and future career development has become a central concern in talent cultivation. Career planning, an important process through which students come to understand themselves, the professional world, and their own developmental direction, is not only relevant to students' future career preparation but may also influence their learning engagement during their time at university. Recent studies have shown that structured career planning education can enhance university students’ career adaptability and career decision-making self-efficacy, suggesting that career-related educational experiences may shape students’ academic and developmental trajectories (Zhang et al., 2025). Learning engagement, as a key indicator of learning quality and educational outcomes, is a complex and multidimensional construct that is closely related to students’ academic development and educational success (Bergdahl et al., 2024). In this study, it is primarily manifested in cognitive, behavioral, and practical dimensions; it is shaped by external factors such as the learning environment and teacher support, as well as by internal factors related to the learner's own cognition and attitudes.

On this basis, career planning's influence on learning engagement may not be limited to a direct effect; it may also be realized indirectly through students' degree of identification with their chosen major and their confidence in their own learning ability. Recent evidence suggests that career education participation can enhance academic self-efficacy through career adaptability and learning engagement, indicating that career-related learning experiences may influence students’ academic confidence and engagement processes (Pang et al., 2025). From this perspective, the effect of career planning on learning engagement may operate not only directly but also indirectly through internal mechanisms such as professional identity and academic self-efficacy. Previous studies have shown that professional identity and academic self-efficacy are closely associated with students’ learning engagement, and that self-efficacy may play an important mediating role in the relationship between professional identity and learning engagement (Chen et al., 2025; Liao et al., 2024). At the same time, vocational undergraduate and applied undergraduate programs differ in terms of their training objectives, curriculum structures, and practice orientations. Since career adaptability and academic engagement have also been identified as important processes in higher education students’ development, it is worth exploring whether the effect of career planning on learning engagement differs across these two types of undergraduate students (Oliveira & Marques, 2024). Accordingly, this paper focuses on the relationship between career

planning and learning engagement, with particular attention to the direct effect of career planning, its mediating mechanisms, and whether these effects vary across undergraduate types, with a view to providing a reference for optimizing career planning education and improving the quality of talent cultivation in universities.

Existing research has addressed college students' career planning, learning engagement, and the factors influencing them to a considerable extent, but most studies focus on specific variables and rarely conduct a systematic analysis of students' career planning levels, learning engagement, and their interrelationship. Moreover, whether career planning affects learning engagement, whether this effect differs between vocational undergraduate and applied undergraduate students, and the mediating roles of professional identity and academic self-efficacy still lack clear empirical evidence. Against this backdrop, this paper takes as its research subjects the students of an applied university in Shandong Province that offers both applied and vocational undergraduate programs, and analyzes the relationship between career planning and learning engagement, focusing on three key questions:

First, does career planning significantly promote students' learning engagement? Second, does career planning affect learning engagement through professional identity and academic self-efficacy? Third, does the effect of career planning on learning engagement differ according to undergraduate type? Exploring these questions helps to further understand the intrinsic connection between college students' career awareness and their current learning investment, and can provide empirical evidence for universities to optimize career planning education, strengthen students' intrinsic motivation for learning, and improve the quality of talent cultivation.

2. Literature Review and Research Hypotheses

Career planning has long been regarded as an important developmental process through which students understand themselves, explore the occupational world, clarify future goals, and translate career expectations into concrete educational and professional actions. From the perspective of social cognitive career theory, students’ career development is shaped by the interaction of personal beliefs, learning experiences, outcome expectations, and contextual supports (Lent et al., 1994). Career construction theory further emphasizes that individuals need career adaptability resources, such as concern, control, curiosity, and confidence, to cope with educational and occupational transitions (Savickas & Porfeli, 2012). These theoretical perspectives suggest that career planning is not merely a preparatory activity for employment after graduation, but also a psychological and behavioral process that may influence students’ current learning motivation, academic choices, and engagement in university learning.

In higher education, career planning is particularly important because university students are situated at the intersection between academic learning and future occupational development. Students who actively explore career information, clarify professional goals, and formulate concrete plans are more likely to understand the relevance of their current studies to future career pathways. Existing research has shown that career-related competencies, such as career adaptability, career maturity, career exploration, and career decision-making self-efficacy, are closely related to students’ academic development and psychological adjustment. For example, Kleine et al. (2021), in a meta-analysis of students’ career exploration, found that career exploration is associated with multiple developmental outcomes. Jiang et al. (2022) showed that career adaptability and career decision-making self-efficacy play important mediating roles in the relationship between parental autonomy support and academic engagement among Chinese secondary vocational students. Liu, Zhang, Dang, and Gao (2023) further found that career education skills can promote career adaptability through career decision-making self-efficacy among Chinese college students. These studies indicate that career-related awareness and planning may provide students with clearer learning direction and stronger motivation to invest in academic activities.

Learning engagement is widely regarded as a key indicator of learning quality, academic development, and educational effectiveness. Fredricks et al. (2004) conceptualized engagement as a multidimensional construct including behavioral, emotional, and cognitive engagement. Behavioral engagement refers to participation, effort, persistence, and involvement in learning activities; cognitive engagement emphasizes deep processing, strategic learning, and psychological investment; emotional engagement concerns interest, belonging, value identification, and affective responses to learning. Later studies in higher education further emphasized that learning engagement should be understood as a dynamic interaction between students and their educational environment rather than as a fixed individual trait (Kahu & Nelson, 2018). In technology-enhanced and higher education contexts, Bond et al. (2020) and Bergdahl et al. (2024) also showed that engagement research often covers behavioral, cognitive, affective, social, and collaborative dimensions, although behavioral indicators are frequently more visible and more commonly measured.

For vocational undergraduate and applied undergraduate students, learning engagement may have a stronger practical orientation than in traditional academic programs. In addition to cognitive and behavioral engagement, students are expected to participate in practical training, skill competitions, professional certification, internships, and applied learning activities. Therefore, learning engagement in this context should not be limited to classroom attendance, assignment completion, or cognitive effort, but should also include students' willingness to connect academic learning with practical skill development and professional preparation. This practical dimension is especially relevant for applied universities, whose educational goals emphasize employability, applied competence, and the integration of theory with practice.

The relationship between career planning and learning engagement can be understood through the motivational function of future orientation. When students have clearer career goals, they are more likely to perceive their current learning as meaningful, useful, and connected to future development. This perceived relevance can strengthen their willingness to invest cognitive effort, persist in academic tasks, and participate in practical activities. Oliveira and Marques (2024) found that career adaptability and academic engagement are important processes related to college students' life satisfaction. Pang et al. (2025) further showed that participation in career education can enhance academic self-efficacy through the sequential mediating roles of career adaptability and learning engagement. These findings suggest that career-related development and academic engagement are not separate processes; rather, they may mutually reinforce each other during students' educational development.

However, existing research has more often focused on career adaptability, career decision-making self-efficacy, or employability, while relatively fewer studies have directly examined career planning as a predictor of learning engagement. Career planning is more specific than general career adaptability because it includes not only adaptive psychological resources but also concrete processes such as career exploration, goal clarification, and plan execution. Among these dimensions, career planning execution may be particularly important because learning engagement requires students to transform abstract goals into actual learning behavior. In other words, it is not enough for students to know their future direction; they also need to adjust their learning arrangements, persist in academic tasks, and take action in relation to their career goals. Therefore, career planning may influence learning engagement not only through students' awareness of future careers but also through their ability to implement career-related learning plans.

Professional identity is another important factor connecting career planning and learning engagement. Professional identity refers to students' recognition of, emotional attachment to, and value identification with their chosen major or professional field. Students with stronger professional identity are more likely to believe that their major is meaningful, socially valuable, and consistent with their future development. Previous studies have shown that professional identity is closely related to learning engagement. Yu et al. (2021) found that Chinese undergraduate tourism students' professional identity significantly influenced their learning engagement. Chen et al. (2024) examined tourism students in China and found significant structural relationships among professional identity, academic self-efficacy, learning

engagement, and university support. Chen et al. (2025) further reported that different dimensions of professional identity positively influenced university students' learning engagement, with academic self-efficacy playing a mediating role in this relationship. These studies suggest that when students identify more strongly with their major, they are more likely to invest time, energy, and effort in learning.

Career planning may strengthen professional identity because it helps students understand the connection between their major and future occupational opportunities. Through career exploration, students can better understand the occupational value of their discipline; through goal clarification, they can connect their academic program with future career pathways; and through planning execution, they can experience the practical usefulness of professional learning. In this process, students may gradually develop stronger belonging, pride, and recognition toward their major. Research in engineering, tourism, and nursing education has shown that professional identity is linked with career adaptability, learning engagement, self-efficacy, and academic achievement (Liu, Ji, Zhang, & Gao, 2023; Liao et al., 2024; Zou et al., 2024). Therefore, professional identity may function as an important internal mechanism through which career planning promotes learning engagement.

Academic self-efficacy is also closely associated with learning engagement. It refers to students' beliefs about their ability to master academic knowledge, complete learning tasks, solve learning problems, and achieve educational goals. According to self-efficacy theory, students who believe they are capable of success are more likely to set challenging goals, persist when facing difficulties, and adopt effective learning strategies (Bandura, 1977; Zimmerman, 2000). In higher education, academic self-efficacy is therefore a key psychological resource that supports students' learning motivation and sustained engagement. Luo et al. (2023) found that academic self-efficacy, learning engagement, and academic achievement were significantly and positively related among Chinese college students, and that learning engagement mediated the relationship between self-efficacy and achievement. Meng and Zhang (2023) similarly reported that academic engagement mediated the effect of academic self-efficacy on university students' academic performance. More recent studies have also shown that academic self-efficacy contributes to online learning engagement, academic resilience, and multidimensional engagement in higher education contexts (Cao et al., 2024; Getenet et al., 2024; Guo et al., 2025).

Career planning may enhance academic self-efficacy in several ways. First, clear career planning can reduce uncertainty and help students establish more specific academic goals. When students know why they are learning and how current learning relates to future development, they may feel more in control of their academic path. Second, career planning execution requires students to make plans, take action, adjust strategies, and evaluate progress. These processes may provide mastery experiences, which are an important source of self-efficacy. Third, when students perceive a closer link between their academic learning and future career success, they may be more willing to believe that their academic effort is worthwhile and achievable. As a result, students with stronger career planning may develop greater confidence in completing learning tasks, which in turn promotes deeper and more sustained learning engagement.

The relationship among career planning, professional identity, academic self-efficacy, and learning engagement is particularly meaningful in vocational undergraduate and applied undergraduate education. These two types of undergraduate programs share a strong practice-oriented orientation, but they may differ in training objectives, curriculum structure, student background, and the degree of emphasis on occupational skills. Vocational undergraduate education usually places greater emphasis on practical competence, professional certification, and direct employment preparation, whereas applied undergraduate education tends to combine disciplinary knowledge with applied practice and professional development. These differences may influence how students understand career planning and how strongly career planning is transformed into learning engagement. Nevertheless, both groups need to

connect current learning with future career development, suggesting that career planning may have a broadly positive effect across both educational types.

At the same time, the existing literature has not sufficiently examined whether the effect of career planning on learning engagement differs between vocational undergraduate and applied undergraduate students. Many previous studies have focused on general university students, secondary vocational students, nursing students, tourism students, or engineering students, but fewer studies have directly compared different types of undergraduate education within the same institutional context. This leaves an important gap in understanding whether career planning plays a similar or different role across practice-oriented undergraduate groups. In particular, given the rapid development of vocational undergraduate education and applied universities in China, it is necessary to further examine how students' career planning relates to their cognitive, behavioral, and practical engagement.

Overall, existing studies have provided a strong foundation for understanding the relationships among career development, professional identity, academic self-efficacy, and learning engagement. However, three limitations remain. First, much of the existing research emphasizes career adaptability, career maturity, or career decision-making self-efficacy, while the direct relationship between career planning and learning engagement has received less empirical attention. Second, although professional identity and academic self-efficacy have been shown to be important predictors of learning engagement, their mediating roles in the relationship between career planning and learning engagement remain insufficiently examined. Third, comparative evidence on vocational undergraduate and applied undergraduate students remains limited. Addressing these gaps can help clarify whether career planning is only a future-oriented employment preparation process, or whether it also functions as an important factor shaping students' present learning engagement.

In response to the above research gaps, this study develops an analytical framework in which career planning is treated as the core independent variable, learning engagement and its three dimensions are treated as outcome variables, professional identity and academic self-efficacy are introduced as mediating variables, and undergraduate type is incorporated as a grouping variable for heterogeneity analysis. This framework allows the study to examine not only whether career planning promotes students' learning engagement, but also through which internal mechanisms this relationship operates and whether the relationship varies between vocational undergraduate and applied undergraduate students. Accordingly, the following hypotheses are proposed:

H1: Career planning has a significant positive effect on students' learning engagement.

H2: Professional identity mediates the relationship between career planning and learning engagement.

H3: Academic self-efficacy mediates the relationship between career planning and learning engagement.

H4: Undergraduate type moderates the relationship between career planning and learning engagement.

Figure 1 presents the theoretical analytical framework of this paper. Career planning is the core independent variable, learning engagement is the dependent variable, and professional identity and academic self-efficacy are the two mediating variables. This study holds that career planning can, on one hand, directly promote students' learning engagement and, on the other hand, indirectly strengthen their cognitive, behavioral, and practical engagement by enhancing professional identity and academic self-efficacy. Furthermore, this paper investigates whether there are differences between vocational undergraduate and applied undergraduate students, in order to test whether the effect of career planning on learning engagement is heterogeneous.

3. Data, Variables, and Research Models

3.1 Data Sources

The Student Career Planning and Learning Behavior Survey Questionnaire used in this study was developed by adapting and integrating several established scales and related research in light of the learning contexts of vocational undergraduate and applied undergraduate students. Specifically, the career planning section draws primarily from Super's Career Development Inventory (CDI) and Crites's Career Maturity Inventory (CMI), supplemented by items related to skill training and professional certification that reflect the practice-oriented characteristics of vocational undergraduate education. The learning engagement section is based mainly on Biggs's Study Process Questionnaire (SPQ) and the NSSE-China learning engagement framework, with an additional practical skills engagement dimension added to reflect the applied and practical emphases of vocational undergraduate programs. The professional identity section was adapted from existing scales measuring college students' professional identity. The academic self-efficacy section was adapted from the relevant dimensions of Pintrich's Motivated Strategies for Learning Questionnaire (MSLQ). Overall, this questionnaire was not directly adapted from any single existing scale; rather, it was formed through the integration, selection, and localized revision of multiple established measurement instruments in light of the themes and target population of this study.

The questionnaire was administered to undergraduate students at a local applied university in Shandong Province, covering basic information, career planning, learning engagement, professional identity, academic self-efficacy, and open-ended feedback. The survey was conducted anonymously to reduce respondent concerns and improve the authenticity of responses. All core scale items (other than basic information questions) used a seven-point Likert scale, with higher scores indicating greater agreement or higher levels of performance on the corresponding dimension. The final valid sample consists of 1,322 vocational undergraduate students and 778 applied undergraduate students. The higher number of responses from the former group likely reflects the fact that the research team is primarily affiliated with the university's vocational education college, which facilitated questionnaire distribution and student willingness to respond; as a more established educational form, the applied undergraduate students showed relatively lower willingness to participate in the survey. Although the two groups differ in sample size, both are sufficient to meet the statistical needs of the analysis.

Before conducting formal statistical analyses, the raw data were systematically cleaned to improve sample quality and the reliability of empirical results. Specifically, low-quality questionnaires were identified by combining response time and response pattern recognition; questionnaires completed in fewer than 45 seconds with completely identical answers across all 32 core scale items were removed. To avoid any distortion caused by duplicate submissions, records were further compared on the basis of basic information variables and scale responses; duplicate entries with identical basic information and scale answers were handled by retaining only the first valid questionnaire and deleting the remaining records. After this cleaning process, a final sample of 2,100 valid questionnaires was obtained for subsequent descriptive statistics, regression analysis, and mediation effect testing.

3.2 Variable Selection

The dependent variable in this paper is learning engagement. Based on the questionnaire design, learning engagement consists of three dimensions: cognitive engagement, behavioral engagement, and practical engagement. Cognitive engagement primarily reflects the depth of students' thinking, their reflective awareness, and their processing of knowledge in the learning process. Behavioral engagement is manifested in explicit learning behaviors such as assignment completion, autonomous learning, and classroom participation. Practical engagement emphasizes the extent to which students proactively apply their learning through practical training, competitions, professional certification, and other practical activities. In terms of specific measurement, cognitive engagement is measured by items S1-S4, behavioral engagement by S5-S8, and practical engagement by S9-S12. The average scores for each

dimension are calculated separately and then combined into an overall learning engagement score. Higher scores indicate higher levels of learning engagement.

The core independent variable in this paper is career planning. Based on the questionnaire design, career planning encompasses three dimensions: career exploration, career goal clarity, and career planning execution. Career exploration primarily reflects the degree to which students proactively collect occupational information, understand occupational requirements, and consider the match between their own interests and careers. Career goal clarity reflects the degree to which students have a clear sense of their future industry, position, and direction of development. Career planning execution emphasizes students' ability to develop plans around career goals, adjust their learning arrangements, and take concrete action. In terms of specific measurement, career exploration is measured by items C1-C4, career goal clarity by C5-C8, and career planning execution by C9-C12. The average scores for each dimension are calculated separately and then combined into an overall career planning score. Higher scores indicate higher levels of career planning.

In order to further reveal the underlying mechanisms through which career planning influences learning engagement, this paper introduces two mediating variables: professional identity and academic self-efficacy. Professional identity is measured by items I1-I4, primarily reflecting students' enthusiasm for, sense of belonging to, and pride in their major, as well as their recognition of its social value. Academic self-efficacy is measured by items I5-I8, primarily reflecting students' confidence in their ability to master specialized knowledge, complete learning tasks, and cope with complex learning content. The average scores across items are used as the measured values for both variables.

To improve the robustness of the model estimates, this paper controls for the following variables: gender, grade level, major category, undergraduate type, place of origin, father's education level, mother's education level, academic ranking, whether the student holds a student leadership position, whether the student has participated in a career planning course or related activities, and whether the student has part-time work or internship experience. These variables may simultaneously affect both students' career planning levels and their learning engagement, and therefore need to be controlled for in the model. A summary of all variables used in this study, including their types, names, items/dimensions, and descriptions, is presented in Table 1 below.

Table 1
Main Variables and Their Descriptions

Variable Type	Variable Name	Items/Dimensions	Description
Dependent variable	Overall learning engagement	S1-S12	Composed of cognitive, behavioral, and practical engagement; reflects students' overall level of learning engagement. Higher scores indicate higher engagement.
Dependent variable	Cognitive engagement	S1-S4	Reflects depth of thinking, reflective awareness, and knowledge processing in learning.
Dependent variable	Behavioral engagement	S5-S8	Reflects external learning behaviors such as assignment completion, autonomous learning, and classroom participation.
Dependent variable	Practical engagement	S9-S12	Reflects the degree to which students extend learning into lab/training activities, skill competitions, professional certification, and social practice.
Independent variable	Overall career planning	C1-C12	Composed of career exploration, goal clarity, and execution; reflects students' overall career planning level. Higher scores indicate higher career planning.
Independent variable	Career exploration	C1-C4	Reflects the degree to which students proactively seek occupational information, understand requirements, and consider person-career fit.
Independent variable	Career goal clarity	C5-C8	Reflects the degree to which students have a clear sense of their future industry, position, and direction.
Independent variable	Career planning execution	C9-C12	Reflects students' ability to develop plans around career goals, adjust learning, and sustain action.
Mediating variable	Professional identity	I1-I4	Reflects students' emotional investment in, sense of belonging to, and pride in their major, and their recognition of its social value.
Mediating variable	Academic self-efficacy	I5-I8	Reflects students' confidence in their ability to master specialized knowledge, complete learning tasks, and cope with complex learning content.

Note: The control variables include: Gender, grade, major category, undergraduate type, place of origin, parents' education, academic ranking, student leadership, career planning course, part-time/internship.

3.3 Reliability and Validity Testing

Since all core variables in this study are measured by multi-item scales, it is necessary to test the reliability and validity of the scales before formal model estimation. Cronbach's alpha coefficients are used to assess the internal consistency of the scales; KMO and Bartlett's test of sphericity are used to determine whether the sample data are appropriate for factor analysis; and exploratory factor analysis can further validate the structural validity of the career planning, learning engagement, professional identity, and academic self-efficacy scales. If the relevant indices all meet acceptable standards, this indicates that the questionnaire is of good measurement quality and suitable for subsequent empirical analysis. Cronbach's alpha results indicate that all scales and their dimensions demonstrate high internal consistency. Specifically, the alpha coefficient for the overall career planning scale is 0.976, for the overall learning engagement scale 0.980, for the professional identity scale 0.970, and for the academic self-efficacy scale 0.976. The alpha coefficients for the sub-dimensions—career exploration, career goal clarity, career planning execution, cognitive engagement, behavioral engagement, and practical engagement—all exceed 0.90. Overall, all scales achieve high reliability levels and can measure their respective constructs in a stable manner. The detailed reliability test results for each scale and its sub-dimensions are reported in Table 2 below.

Table 2
Scale Reliability Test Results

Scale / Dimension	No. of Items	Cronbach's α
Overall career planning scale	12	0.976
Career exploration	4	0.927
Career goal clarity	4	0.967
Career planning execution	4	0.965
Overall learning engagement scale	12	0.980
Cognitive engagement	4	0.970
Behavioral engagement	4	0.949
Practical engagement	4	0.954
Professional identity	4	0.970
Academic self-efficacy	4	0.976

Note: Cronbach's α > 0.70 is generally considered acceptable; > 0.80 indicates good reliability; > 0.90 indicates high internal consistency.

3.4 CITC Analysis

Examination of the Corrected Item-Total Correlation (CITC) results at the item level reveals that the r.drop values for the overall career planning scale range from 0.796 to 0.913; for the overall learning engagement scale from 0.826 to 0.910; for professional identity from 0.894 to 0.936; and for academic self-efficacy from 0.933 to 0.946. This indicates that each item maintains high consistency with its overall scale, and no items deviate markedly from their assigned dimension. The detailed CITC results for all scales and their sub-dimensions are presented in Table 3 below.

Table 3
CITC Results Summary for All Scales

Scale / Dimension	CITC Range	Consistency Judgment
Career exploration	0.807–0.858	High consistency between items and dimensions
Career goal clarity	0.898–0.931	Very high consistency between items and dimensions
Career planning execution	0.898–0.927	Very high consistency between items and dimensions
Overall learning engagement scale	0.826–0.910	High consistency between items and the overall scale
Cognitive engagement	0.916–0.935	Very high consistency between items and dimensions
Behavioral engagement	0.831–0.917	High consistency between items and dimensions
Practical engagement	0.855–0.916	High consistency between items and dimensions
Professional identity	0.894–0.936	Very high consistency between items and scale
Academic self-efficacy	0.933–0.946	Very high consistency between items and scale

3.5 Validity Analysis Results

To test whether the data are appropriate for factor analysis, this paper conducted KMO and Bartlett's test of sphericity for each scale. Results show that the KMO values for all scales exceed 0.90, and Bartlett's tests of sphericity are all

significant at the 0.001 level, indicating that the sample data have good correlational structure and are appropriate for factor analysis. The detailed KMO and Bartlett's test results for each scale are presented in Table 4 below.

Table 4
KMO and Bartlett's Test Results for Scale Validity

Scale	KMO	Bartlett χ^2	df	p-value
Overall career planning scale	0.964	34680.96	66	< 0.001
Overall learning engagement scale	0.963	36655.23	66	< 0.001
Mediating variable scale (I1-I8)	0.948	27551.31	28	< 0.001
Full scale (32 items)	0.985	108782.30	496	< 0.001

3.6 Parallel Analysis and Supplementary Remarks on Exploratory Factor Analysis

Parallel analysis results support the extraction of 3 factors from the career planning scale, 3 factors from the learning engagement scale, and 2 factors from the mediating variable (I) scale, which is broadly consistent with the original theoretical structure of the questionnaire.

Further exploratory factor analysis shows that the three-dimensional structure of the career planning scale is relatively clear: C1-C4 load primarily on the career exploration factor, C5-C8 on the career goal clarity factor, and C9-C12 on the career planning execution factor, with cumulative explained variance of 74.0%.

Meanwhile, although the learning engagement scale is theoretically divided into three dimensions (cognitive, behavioral, and practical engagement), the 12 items in the current sample converge strongly on a single dominant factor, with the first factor explaining 80.5% of the variance. This result suggests that learning engagement in the present sample contains a strong general engagement factor. Nevertheless, the three sub-dimensions were retained for theory-driven analysis because cognitive, behavioral, and practical engagement represent conceptually distinct forms of student engagement in the context of vocational and applied undergraduate education. Therefore, the dimension-specific analyses should be interpreted as theoretically informed supplementary analyses rather than as evidence that the three dimensions are fully independent constructs. Similarly, the professional identity and academic self-efficacy items in the I scale also exhibit strong single-factor convergence, with the first factor explaining 86.4% of the variance. This indicates high correlations among the different dimensions.

Overall, the scales in this study demonstrate high internal consistency and a sound basis for structural validity, fully capable of supporting subsequent descriptive statistics, difference testing, regression analysis, and mediation effect testing. In light of space constraints and the focus of the paper, detailed item lists and factor loading matrices are not presented in the main text; they can be provided as appendix materials upon request.

3.7 Research Models

Given that career planning, learning engagement, professional identity, and academic self-efficacy are all composed of multi-item scales and synthesized into continuous variables, this study primarily employs multiple linear regression models to examine the effect of career planning on learning engagement. To further reveal the mechanisms through which career planning influences learning engagement, mediation models are constructed, with undergraduate type incorporated as an additional dimension for heterogeneity analysis.

A baseline regression model is first constructed to test whether career planning significantly improves students' learning engagement:

$$HELLO\,TESTLE = \alpha + \beta CP + \Sigma\gamma Control + \epsilon$$

1

where LE_i denotes student i's level of learning engagement, CP_i denotes the level of career planning, $Control_i$ denotes the control variables, and ε_i is the random error term. If β_1 is significantly positive, career planning is said to have a significant positive effect on learning engagement.

To further examine the effect of career planning on different types of learning engagement, cognitive engagement, behavioral engagement, and practical engagement are used separately as dependent variables:

$$Cog = \alpha + \beta CP + \Sigma\gamma Control + \epsilon$$

2

$$Beh = \alpha + \beta CP + \Sigma\gamma Control + \epsilon$$

3

$$Pra = \alpha + \beta CP + \Sigma\gamma Control + \epsilon$$

4

where Cog_i, Beh_i, and Pra_i denote cognitive, behavioral, and practical engagement, respectively. By comparing the regression coefficients of career planning across the three dimensions, it is possible to identify which type of learning engagement career planning is most likely to promote.

Additionally, to test the underlying mechanisms through which career planning influences learning engagement, professional identity and academic self-efficacy are each used as mediating variables. In the first step, the effect of career planning on the mediating variables is tested:

$$PI = \alpha + \beta CP + \Sigma\gamma Control + \epsilon$$

5

$$ASE = \alpha + \beta CP + \Sigma\gamma Control + \epsilon$$

6

In the second step, the mediating variables are added to the baseline model:

$$LE = \alpha + \beta CP + \beta PI + \beta ASE + \Sigma\gamma Control + \epsilon$$

7

If career planning has a significant positive effect on professional identity and academic self-efficacy, and if the regression coefficient of career planning on learning engagement decreases after the mediating variables are included, the two variables are considered to play a mediating role between career planning and learning engagement.

In addition to the stepwise regression approach, the indirect effects were further examined using a bootstrap procedure with 5,000 resamples. The mediating effect was considered statistically significant when the 95% confidence interval of the indirect effect did not include zero. This procedure was used to provide a more direct test of the mediating roles of professional identity and academic self-efficacy.

Given the paper's interest in differences between vocational undergraduate and applied undergraduate students, an interaction term between career planning and undergraduate type is introduced to test whether the effect of career planning on learning engagement differs by undergraduate type:

$$LE_i = \alpha + \beta_1 CP_i + \beta_2 Type_i + \beta_3 (CP_i \times Type_i) + \sum \gamma_k Control_{ki} + \epsilon_i$$

8

where $Type_i$ denotes the student's undergraduate type. If the coefficient on the interaction term is significant, the effect of career planning on learning engagement differs significantly between vocational undergraduate and applied undergraduate students.

4. Results and Analysis

4.1 Descriptive Statistics and Correlation Analysis

To provide a preliminary overview of the distribution of each core variable in the sample, this paper first conducts descriptive statistical analysis of career planning, learning engagement, professional identity, and academic self-efficacy. As shown in Table 5, the mean scores of all core variables exceed the scale midpoint of 4, indicating that the sample students are at a mid-to-high level overall in terms of career planning, learning engagement, professional identity, and academic self-efficacy. Specifically, the mean score for overall career planning is 4.800, for overall learning engagement 4.808, and for professional identity and academic self-efficacy 4.908 and 4.893, respectively, indicating that the students surveyed generally possess a certain degree of career awareness and a basis for learning investment, as well as relatively positive professional affect and learning ability beliefs. Among the three career planning dimensions, career exploration has the highest mean, suggesting that students are relatively more active in proactively seeking occupational information, understanding requirements, and considering the match between their interests and careers; the mean for career goal clarity is slightly lower, indicating that while some students have developed a degree of career exploration awareness, they still have room to improve in terms of the clarity of their future direction and career goals. Concerning learning engagement, behavioral engagement has the highest mean, while practical engagement has a relatively lower mean, suggesting that students are more active in explicit learning behaviors such as assignment completion, autonomous learning, and classroom participation, but invest relatively less in practical training, competitions, professional certification, and experiential activities.

Table 5
Descriptive Statistics

Variable	Mean (M)	SD	Min	Max
Overall career planning	4.800	1.411	1.0	7.0
Career exploration	4.842	1.466	1.0	7.0
Career goal clarity	4.752	1.508	1.0	7.0
Career planning execution	4.804	1.473	1.0	7.0
Overall learning engagement	4.808	1.389	1.0	7.0
Cognitive engagement	4.810	1.451	1.0	7.0
Behavioral engagement	4.887	1.407	1.0	7.0
Practical engagement	4.728	1.485	1.0	7.0
Professional identity	4.908	1.469	1.0	7.0
Academic self-efficacy	4.893	1.446	1.0	7.0

Building on the descriptive statistics, this paper further employs Pearson correlation analysis to examine the relationships among the core variables, with results shown in Table 6. The analysis reveals a significant positive correlation between overall career planning and overall learning engagement ($r = 0.913$, $p < 0.001$), indicating that higher levels of career planning are associated with higher levels of overall learning engagement. At the same time, career planning is significantly and positively correlated with all three dimensions of learning engagement: the correlation with cognitive engagement is 0.896, with behavioral engagement 0.875, and with practical engagement 0.857, all significant at the 0.001 level. This indicates that career planning is closely associated not only with students' explicit learning behaviors but also with deeper cognitive processing and practical extension. Comparatively, the correlation between career planning and cognitive engagement is the highest, suggesting that career planning may primarily strengthen students' sense of purpose, direction, and meaning in learning, which in turn deepens their level of thinking and cognitive engagement.

In addition, career planning is significantly and positively correlated with professional identity and academic self-efficacy, with correlation coefficients of 0.822 and 0.843, respectively, both significant at the 0.001 level. This indicates that higher levels of career planning are associated with stronger professional belonging and value identification, as well as greater confidence in the ability to handle academic tasks. At the same time, overall learning engagement is significantly and positively correlated with professional identity and academic self-efficacy, with correlation coefficients of 0.883 and 0.908, indicating that professional identity and academic self-efficacy are closely associated not only with career planning but also with students' level of learning investment. Overall, all core variables exhibit significant positive correlations, providing preliminary support for the subsequent regression analysis and mediation effect testing, and demonstrating that career planning, professional identity, academic self-efficacy, and learning engagement are closely interconnected.

Table 6
Correlation Analysis

Variable	1	2	3	4	5	6	7	8	9	10
1	1									
2	0.940***	1								
3	0.960***	0.849***	1							
4	0.955***	0.837***	0.892***	1						
5	0.913***	0.836***	0.856***	0.883***	1					
6	0.896***	0.816***	0.844***	0.863***	0.970***	1				
7	0.875***	0.798***	0.815***	0.859***	0.953***	0.893***	1			
8	0.857***	0.792***	0.800***	0.803***	0.939***	0.856***	0.836***	1		
9	0.822***	0.749***	0.780***	0.818***	0.883***	0.837***	0.861***	0.843***	1	
10	0.843***	0.770***	0.800***	0.837***	0.908***	0.865***	0.882***	0.867***	0.894***	1

Note: *** $p < 0.001$. *Variable names corresponding to numbers 1–10 are listed in Appendix A.*

4.2 Main Regression Results

To examine the overall effect of career planning on learning engagement, multiple linear regression models are constructed with overall learning engagement, cognitive engagement, behavioral engagement, and practical engagement as dependent variables, controlling for gender, grade level, major category, undergraduate type, place of origin, parents' education level, academic ranking, student leadership experience, career planning course experience, and part-time or internship experience. Table 7 reports the regression results for career planning on overall learning engagement and its three dimensions.

Table 7
Regression Results of Career Planning on Learning Engagement

Variable	Model 1 Overall Engagement	Model 2 Cognitive Engagement	Model 3 Behavioral Engagement	Model 4 Practical Engagement
Career planning	0.8965*** (0.0116)	0.9259*** (0.0116)	0.8680*** (0.0136)	0.8956*** (0.0164)
Controls	Yes	Yes	Yes	Yes
R^2	0.8365	0.8072	0.7702	0.7423
Adj. R^2	0.8342	0.8045	0.7670	0.7387
N	2100	2100	2100	2100

*Note: Robust standard errors in parentheses; ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.*

The results in Table 7 show that, after including all control variables, career planning has a significant positive effect on overall learning engagement ($\beta = 0.8965$, $p < 0.01$), indicating that higher career planning levels are associated with

higher overall learning engagement. Examining the three dimensions separately, career planning has a significant positive effect on cognitive engagement (β = 0.9259), behavioral engagement (β = 0.8680), and practical engagement (β = 0.8956), all significant at the 1% level. Comparatively, career planning has the strongest effect on cognitive engagement, followed by practical engagement and then behavioral engagement. This suggests that career planning not only promotes students' explicit learning behaviors and practical participation but, more importantly, first strengthens their depth of understanding of learning tasks, goal awareness, and cognitive processing, thereby driving higher levels of learning engagement. Overall, the results in Table 7 strongly support the core research hypothesis that career planning significantly promotes learning engagement.

At the same time, to further identify the relative contributions of the different dimensions within career planning, career exploration, career goal clarity, and career planning execution are entered simultaneously into the regression model with overall learning engagement as the dependent variable. Table 8 presents the regression results for the three dimensions of career planning on learning engagement, controlling for other background variables.

Table 8
Regression Results for Career Planning Dimensions on Learning Engagement

Variable	**Model 5: Overall Learning Engagement**
Career exploration	0.1882***
	(0.0288)
Career goal clarity	0.1276***
	(0.0371)
Career planning execution	0.5832***
	(0.0399)
Controls	Yes
R^2	0.8533
Adj. R^2	0.8511
N	2100
Note: Robust standard errors in parentheses; all three dimensions are entered simultaneously. Career planning execution shows the largest coefficient.	

The results in Table 8 show that career exploration, career goal clarity, and career planning execution all have significant positive effects on learning engagement, indicating that career planning does not operate through a single dimension but influences students' learning engagement through multiple pathways—information exploration, goal clarification, and action implementation. Specifically, the regression coefficient for career exploration is 0.1882, for career goal clarity 0.1276, and for career planning execution 0.5832, all significant at the 1% level. Comparing the three coefficients, career planning execution has by far the strongest effect, substantially exceeding those of career exploration and career goal clarity. This suggests that, compared with 'whether students gather career information' or 'whether students have a clear goal,' what more directly drives learning engagement is students' ability to translate career goals into concrete learning arrangements, sustained behavior, and practical implementation. In other words, the effect of career planning on learning engagement does not rest primarily at the level of cognitive preparation but is more strongly reflected in execution and sustained action.

4.3 Mediation Effect Testing

To further reveal the underlying mechanisms through which career planning influences learning engagement, professional identity and academic self-efficacy are used as mediating variables. Specifically, the effects of career planning on professional identity and academic self-efficacy are first examined; career planning, professional identity, and academic self-efficacy are then included simultaneously in the learning engagement model to compare changes in the regression coefficient of career planning and determine whether the mediating pathways hold. Table 9 reports the mediation effect test results for professional identity and academic self-efficacy.

Table 9
Mediation Effect Tests for Professional Identity and Academic Self-Efficacy

Variable	Model 6 Professional Identity	Model 7 Academic Self-Efficacy	Model 8 Learning Engagement
Career planning	0.8553***	0.8572***	0.4543***
	(0.0152)	(0.0157)	(0.0286)
Professional identity			0.1896***
			(0.0276)
Academic self-efficacy			0.3267***
			(0.0352)
Controls	Yes	Yes	Yes
R^2	0.6836	0.7194	0.9084
Adj. R^2	0.6791	0.7154	0.9070
N	2100	2100	2100

Note: *Robust standard errors are reported in parentheses. All models include the same control variables as the baseline regression, but the coefficients of control variables and constants are not reported for brevity. Model 6 estimates the association between career planning and professional identity; Model 7 estimates the association between career planning and academic self-efficacy; and Model 8 regresses learning engagement on career planning, professional identity, and academic self-efficacy simultaneously. Compared with the baseline coefficient of career planning on learning engagement reported in* Table 7, *Model 1 (β = 0.8965), the coefficient decreases to 0.4543 after professional identity and academic self-efficacy are included, but remains statistically significant. This suggests that professional identity and academic self-efficacy play partial mediating roles in the relationship between career planning and learning engagement. The heterogeneity test by undergraduate type is reported separately in Appendix B.* ***, **, *and* * *denote significance at the 1%, 5%, and 10% levels, respectively.*

The results in Table 9 show that career planning has a significant positive effect on both professional identity (β = 0.8553, $p < 0.01$) and academic self-efficacy (β = 0.8572, $p < 0.01$). This indicates that higher levels of career planning are associated with stronger professional identification and greater confidence in one's own learning ability. After simultaneously including professional identity and academic self-efficacy in the learning engagement model, the regression coefficient of career planning on learning engagement decreases from 0.8965 (Table 7) to 0.4543, but remains significant; at the same time, the regression coefficients of professional identity and academic self-efficacy on learning engagement are 0.1896 and 0.3267, both significant at the 1% level. These results indicate that professional identity and academic self-efficacy play partial mediating roles in the process through which career planning influences learning engagement. Comparing the coefficients of the two mediating variables, academic self-efficacy has a relatively stronger effect, meaning that career planning promotes learning engagement not only by enhancing students' value identification with their major but more significantly by strengthening students' confidence in their own learning ability and task completion capacity, which in turn reinforces their level of learning investment.

Although the regression results in Table 9 provide initial evidence that professional identity and academic self-efficacy play partial mediating roles, the significance of the indirect effects requires further examination. Therefore, this study further conducted a bootstrap mediation test with 5,000 resamples to obtain more direct evidence for the two mediating pathways. Table 10 reports the bootstrap results for the indirect effects of career planning on learning engagement through professional identity and academic self-efficacy, as well as the total indirect effect and the remaining direct effect.

Table 10
Bootstrap Results for Indirect Effects

Path	Effect	Boot SE	95% CI Lower	95% CI Upper	Result
Career planning → Academic self-efficacy → Learning engagement	0.2800	0.0297	0.2218	0.3383	Significant
Total indirect effect	0.4422	0.0241	0.3943	0.4911	Significant
Direct effect	0.4543	0.0279	0.3992	0.5083	Significant

Note: Bootstrap standard errors are reported based on 5,000 resamples. The 95% confidence intervals are percentile bootstrap confidence intervals. Gender, grade level, major category, undergraduate type, place of origin, parents' education level, academic ranking, student leadership experience, career planning course experience, and part-time/internship experience are controlled. A mediating effect is considered significant when the 95% confidence interval does not include zero.

The bootstrap results further confirm the mediating roles of professional identity and academic self-efficacy. As shown in Table 10, the indirect effect of career planning on learning engagement through professional identity is 0.1622, with a 95% confidence interval of [0.1177, 0.2103], which does not include zero. The indirect effect through academic self-efficacy is 0.2800, with a 95% confidence interval of [0.2218, 0.3383], which also does not include zero. These results indicate that both professional identity and academic self-efficacy significantly mediate the relationship between career planning and learning engagement. Moreover, the indirect effect through academic self-efficacy is larger than that through professional identity, suggesting that academic self-efficacy plays a relatively stronger mediating role. The direct effect of career planning remains significant after accounting for the two mediating variables, indicating partial mediation.

4.4 Heterogeneity Analysis

To further test whether the effect pathways differ across undergraduate types, an interaction term between career planning and undergraduate type is introduced into the baseline model. Results show that the coefficient on the interaction term between career planning and undergraduate type is -0.0220, which does not reach statistical significance ($p = 0.374$), indicating that undergraduate type does not significantly moderate the relationship between career planning and learning engagement. This suggests that the positive effect of career planning on learning engagement is broadly consistent across vocational undergraduate and applied undergraduate students and does not vary significantly with undergraduate type. Specific heterogeneity test results are presented in Appendix B.

5. Limitations and Future Research

Despite its contributions, this study should be interpreted in light of several limitations. The analysis is based on cross-sectional survey data, which limits the extent to which causal relationships can be inferred. Although the regression and mediation results indicate that career planning is positively associated with learning engagement and that professional identity and academic self-efficacy serve as significant mediating mechanisms, the present design cannot fully establish the temporal order among these variables. Career planning may enhance students' engagement, but it is

also possible that students who are already more engaged in learning become more willing to clarify their career goals and implement career-related plans. Future research could employ longitudinal designs to examine how career planning, professional identity, academic self-efficacy, and learning engagement develop over time, or use intervention-based designs to evaluate whether structured career planning programs can produce sustained improvements in learning engagement.

The use of self-reported questionnaire data also deserves caution. The anonymous survey procedure and the reliability and validity tests help support the quality of the data, but self-report measures may still be influenced by social desirability, response consistency, and common method variance. This issue is particularly relevant because career planning, professional identity, academic self-efficacy, and learning engagement were all measured through the same questionnaire. Future studies could strengthen the evidence base by integrating multiple data sources, such as learning management system records, course performance, teacher evaluations, career guidance participation records, interviews, or longitudinal tracking data. Such multi-source evidence would make it possible to examine not only students' perceived engagement but also their actual learning behaviors and developmental trajectories.

The sample was drawn from one applied undergraduate university in Shandong Province. Although the study included a relatively large sample of 2,100 valid questionnaires and covered both vocational undergraduate and applied undergraduate students, the findings may still be shaped by the institutional context, regional background, disciplinary composition, and local talent cultivation model. The non-significant moderating effect of undergraduate type suggests that the positive association between career planning and learning engagement is broadly consistent across the two groups in this sample, but this conclusion should not be overgeneralized to all vocational or applied undergraduate institutions. Future research could include universities from different provinces, institutional tiers, and disciplinary fields to test whether the observed relationships remain stable across broader higher education contexts.

The measurement framework was constructed by integrating and adapting several established scales to fit the context of vocational and applied undergraduate education. This approach allowed the study to capture career planning, learning engagement, professional identity, and academic self-efficacy in a context-sensitive way. Nevertheless, the exploratory factor analysis indicated that the learning engagement scale contained a strong general engagement factor, even though the study retained cognitive, behavioral, and practical engagement as theory-driven sub-dimensions. Therefore, the dimension-specific findings should be interpreted as supplementary evidence rather than as definitive proof that the three dimensions operate as fully independent constructs. Further studies could refine the measurement of practical engagement, examine the dimensional structure of learning engagement through confirmatory factor analysis, and test whether the same structure holds across different student groups and institutional contexts.

The study focused on professional identity and academic self-efficacy as two internal mechanisms linking career planning to learning engagement. These mediators are theoretically meaningful and empirically significant, but they do not exhaust the possible pathways through which career planning may shape students' learning experiences. Other motivational, psychological, and contextual factors, such as career adaptability, perceived employability, learning motivation, teacher support, family support, peer influence, institutional career guidance, and access to practical learning opportunities, may also play important roles. Future research could develop more comprehensive models to examine how individual beliefs, institutional support, and career development resources jointly influence students' learning engagement in vocational and applied undergraduate education.

6. Conclusions and Recommendations

Based on 2,100 valid questionnaires, this paper presents an empirical analysis of the effect of career planning on learning engagement among vocational undergraduate and applied undergraduate students. The findings demonstrate that career planning has a significant positive effect on students' learning engagement, and this conclusion remains robust after controlling for gender, grade level, major category, undergraduate type, place of origin, parents' education level, academic ranking, student leadership experience, career planning course experience, and part-time or internship experience. Further analysis reveals that career planning not only significantly improves students' overall learning engagement but also significantly promotes cognitive, behavioral, and practical engagement, with the strongest effect on cognitive engagement. This indicates that career planning first strengthens students' sense of purpose, direction, and depth of cognitive processing in learning, which in turn drives broader learning engagement.

Examining the internal dimensions of career planning, career exploration, career goal clarity, and career planning execution, all have significant positive effects on learning engagement, but career planning execution has the most pronounced effect. This means that, compared with simply gathering career information or setting goals, the ability to translate career goals into concrete learning arrangements, sustained action, and behavioral follow-through is the key driver of student learning engagement. In other words, the effect of career planning on learning engagement does not rest primarily at the level of cognitive preparation but is more strongly reflected in sustained execution and practical action.

The mediation effect test results further demonstrate that professional identity and academic self-efficacy play partial mediating roles in the process through which career planning influences learning engagement. The higher the students' career planning level, the more easily they form an identification with their major, and the more easily they develop confidence in their own learning ability and task completion capacity; in turn, higher professional identity and academic self-efficacy further promote learning engagement. Academic self-efficacy has a relatively stronger mediating effect, indicating that career planning produces a more direct driving effect on learning engagement by strengthening students' belief that 'I can learn well and achieve my goals.

Finally, the heterogeneity analysis shows that the interaction term between career planning and undergraduate type does not reach statistical significance, indicating that there is no significant difference in the positive effect of career planning on learning engagement between vocational undergraduate and applied undergraduate students. That is, despite differences in cultivation orientation and practical emphasis between the two types of undergraduate education, career planning, as an important factor influencing learning engagement, has a broadly universal positive effect. Based on these conclusions, this paper argues that universities should advance career planning education and integrate it throughout the entire talent cultivation process—not only helping students clarify their future direction but also, through curriculum guidance, practical support, and growth feedback mechanisms, further enhancing students' professional identity and academic self-efficacy, thereby achieving sustained improvement in learning engagement.

Declarations

Conflict of Interest declaration: The authors declare that they have no affiliations with or involvement in any organization or entity with any financial interest in the subject matter or materials discussed in this manuscript.

Author Contributions: The first and second authors were responsible for the research design, data collection, and data analysis. The first and second authors contributed to the manuscript writing and revision. All authors have read and agreed to the published version of the manuscript.

Ethics Statement

This study was reviewed by the Vocational Education College Research Ethics Committee, Shandong Youth University of Political Science, and was granted exemption from full ethical review. The exemption was granted in accordance with the committee's institutional ethical review procedures for anonymous, minimal-risk educational questionnaire studies that do not collect personally identifiable or sensitive private information.

The basis for applying this exemption was that the study used a cross-sectional anonymous questionnaire survey, posed no more than minimal risk to participants, involved no intervention or experimental manipulation, and did not collect names, student ID numbers, phone numbers, email addresses, identity documents, medical information, psychological diagnosis information, or other directly identifiable or sensitive private information. The research was performed in accordance with the ethical standards and procedures of the Vocational Education College Research Ethics Committee, Shandong Youth University of Political Science, the institution's guidelines for research involving human participants, and the principles of the Declaration of Helsinki, as applicable.

Before completing the questionnaire, all participants were informed of the purpose of the study, the anonymous nature of the survey, the voluntary nature of participation, the confidentiality of the collected data, and the use of the data for academic research purposes only. As the study involved an anonymous, minimal-risk educational survey and did not collect personally identifiable information, separate written informed consent was not obtained. Completion and submission of the questionnaire were regarded as participants' informed consent to take part in the study.**[1]**

Informed Consent

Informed consent was obtained from all participants. All participants were undergraduate students aged between 18 and 22 years at the time of data collection; therefore, consent from legal guardians was not required. Before completing the questionnaire, participants were informed of the study purpose, voluntary participation, anonymity, confidentiality, and the academic use of the data. As the study involved an anonymous, minimal-risk educational survey and did not collect personally identifiable information, separate written informed consent was not obtained. Completion and submission of the questionnaire were regarded as participants' informed consent to participate in the study.

Data Availability

The anonymised datasets and all supporting materials underlying this study have been submitted as supplementary files through the journal's submission system for peer-review purposes. These materials include the raw and processed datasets, survey instrument, data collection protocol, variable definitions, coding schemes, variable transformation procedures, statistical analysis resources, and other supporting documentation necessary to verify the methodology and findings. No restrictions apply to the availability of these materials for editorial and peer-review assessment.

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Footnotes

1. The institutional exemption procedure of the Vocational Education College Research Ethics Committee, Shandong Youth University of Political Science, is not publicly available online. The stamped ethical review exemption report has been uploaded as supporting documentation. As a publicly accessible national-level reference, the Measures for Ethical Review of Science and Technology (Trial), issued by the Ministry of Science and Technology and other departments of the People's Republic of China, provide that higher education institutions and other relevant institutions are responsible for managing ethical review within their own institutions and that ethics review committees should establish review, supervision, confidentiality, archive-management, and related procedural systems. URL: https://www.most.gov.cn/xxgk/xinxifenlei/fdzdgknr/fgzc/gfxwj/gfxwj2023/202310/t20231008_188309.html

Figures

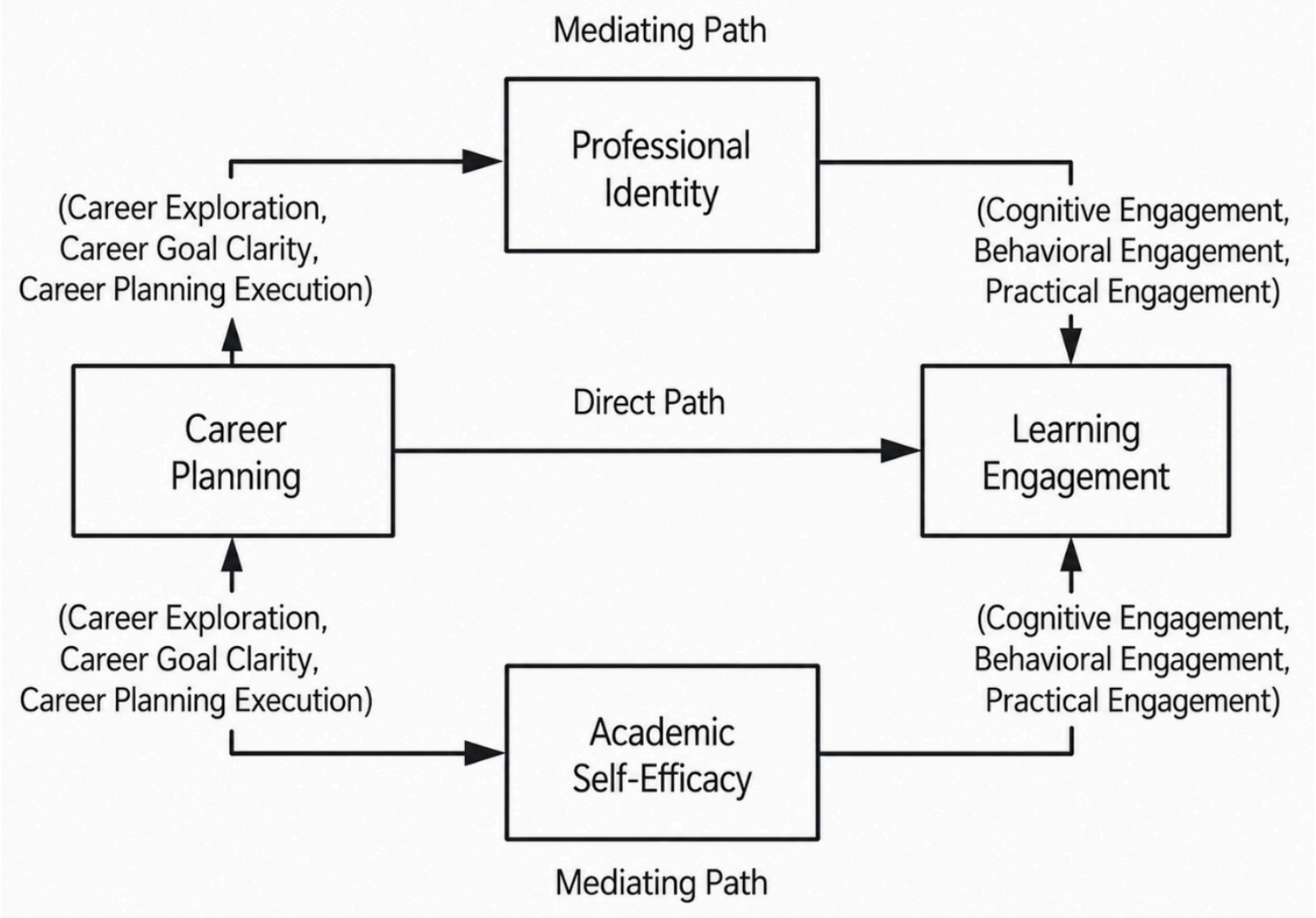


Figure 1

presents the theoretical analytical framework of this paper. Career planning is the core independent variable, learning engagement is the dependent variable, and professional identity and academic self-efficacy are the two mediating variables. This study holds that career planning can, on one hand, directly promote students' learning engagement and, on the other hand, indirectly strengthen their cognitive, behavioral, and practical engagement by enhancing professional identity and academic self-efficacy. Furthermore, this paper investigates whether there are differences between vocational undergraduate and applied undergraduate students, in order to test whether the effect of career planning on learning engagement is heterogeneous.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Reliabilityandvalidityanalysis.r
- Regressioncode.r
- DataAftercleaning.xlsx
- Dataoriginal.xlsx
- Summaryofregressionanalysisresults.xlsx
- SupplementaryFileASurveyInstrumentsandDataCollectionProtocol.docx
- SupplementaryFileBVariableDetailsCodingSchemeandTransformations.docx
- Appendix.docx