A Multivariate Interaction Analysis of the Influencing Mechanism of Employment Competitiveness Among College Students

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Abstract

Against the backdrop of global economic transformation and regional industrial upgrading, the employment competitiveness of college students has become a critical indicator reflecting the quality of higher education and the effectiveness of talent cultivation. This study focuses on college students in Shanxi Province, China—a region undergoing a pivotal shift from a resource-based economy to a diversified development model—and explores the multivariate interaction mechanisms influencing their employment competitiveness. By integrating human capital theory, social capital theory, and career development theory, we construct a comprehensive evaluation model encompassing seven core variables: personal quality (PQ), professional skills (PS), job-hunting ability (JA), career planning (CP), personal resources (PR), social resources (SR), and employment competitiveness (EC). Adopting a mixed-methods approach, including structural equation modeling (SEM) with 487 valid samples and in-depth qualitative interviews with 20 students and 6 faculty members, this study identifies both direct and indirect pathways of influence. The results reveal that personal quality and professional skills exert significant direct effects on employment competitiveness, while job-hunting ability and career planning impact employment competitiveness indirectly through the mediation of personal and social resources. Notably, personal resources and social resources emerge as critical mediating variables, with strong direct effects on employment competitiveness. These findings provide theoretical support for improving college students' employment competitiveness and offer practical guidance for universities, policymakers, and students themselves.

Keywords: Employment Competitiveness; College Students; Multivariate Interaction; Structural Equation Modeling; Personal Resources; Social Resources

1. Introduction

In the context of globalization and rapid technological advancement, the global employment landscape is undergoing profound changes, characterized by intensified competition, diversified job demands, and accelerated skill updating (Tomlinson, 2017). For college students, employment competitiveness is no longer defined solely by academic

performance or diploma credentials but has evolved into a multidimensional concept encompassing adaptability, job-person fit, and long-term developmental potential (Zhao & Liu, 2021). This shift is particularly pronounced in regions undergoing economic restructuring, such as Shanxi Province, China.

Shanxi, historically reliant on coal and other resource-based industries, is currently in a critical stage of economic transformation, aiming to reduce its dependence on traditional industries and develop emerging sectors such as high-tech manufacturing, modern services, and cultural tourism (Gao, 2023). This transformation has reshaped local labor market demands: on one hand, traditional jobs in resource sectors are shrinking; on the other hand, new industries require talents with interdisciplinary skills, practical experience, and strong adaptability. However, college graduates in Shanxi often face challenges such as skill mismatch, insufficient access to employment resources, and weak career planning, which hinder their integration into the evolving labor market (Lu & Wang, 2020).

Against this backdrop, understanding the complex mechanisms influencing college students' employment competitiveness has become an urgent research priority. Traditional studies on employment competitiveness tend to focus on single dimensions, such as human capital (e.g., professional skills) or social capital (e.g., social networks), failing to capture the interactive effects of multiple factors (Bridgstock, 2009). Recent research has highlighted the need for integrative models that consider the synergy between internal individual attributes and external environmental resources (Jackson & Tomlinson, 2020).

This study seeks to address this gap by constructing a multivariate interaction model of employment competitiveness, drawing on three foundational theories:

Human capital theory (Becker, 1964; Mincer, 1974), which emphasizes the role of education, skills, and personal qualities in enhancing productivity and employability;

Social capital theory (Coleman, 1988; Lin, 2001), which focuses on the value of social networks and resources embedded in relationships for accessing employment opportunities;

Career development theory (Super, 1980; Savickas, 2013), which frames career planning and job-hunting ability as key indicators of individuals' agency in navigating career paths.

By examining the direct and indirect effects of variables such as personal quality, professional skills, career planning, and resources (both personal and social) on employment competitiveness, this study aims to answer the following research questions:

What are the direct effects of personal attributes (personal quality, professional skills) on college students' employment competitiveness?

How do career-related abilities (career planning, job-hunting ability) influence employment competitiveness through the mediation of resources (personal and social)?

What is the relative importance of personal resources and social resources in shaping employment competitiveness?

The findings of this study are expected to provide theoretical insights for enriching the literature on employability and offer practical implications for universities, policymakers, and

students to enhance employment competitiveness in the context of regional economic transformation.

2. Literature Review

2.1 Human Capital and Employment Competitiveness

Human capital theory, pioneered by Becker (1964) and Mincer (1974), posits that investments in education, training, and skill development enhance individuals' productivity, thereby increasing their market value and employability. In the context of higher education, human capital is embodied in variables such as professional skills, cognitive abilities, and personal qualities (Bridgstock, 2009).

Professional skills, including discipline-specific knowledge and practical operational abilities, are widely recognized as foundational to employment competitiveness. Wang and He (2021) found that college students with strong professional skills are more likely to secure high-quality jobs, as they can quickly adapt to job requirements and demonstrate productivity in the workplace. Personal quality, encompassing soft skills such as communication, teamwork, and problem-solving, has also gained attention. Tomlinson (2017) argued that in a knowledge-based economy, personal quality acts as a "differentiator" in employment, as technical skills can be standardized, but soft skills are harder to replicate and critical for long-term career development.

Empirical studies in China support these assertions. Lu and Wang (2020) noted that employers in China increasingly value "comprehensive quality" over pure academic performance, with personal qualities such as resilience and innovation being particularly important in fast-changing industries.

2.2 Social Capital and Network Effects

Social capital theory, as developed by Coleman (1988) and Lin (2001), defines social capital as resources embedded in social networks, which can be mobilized to achieve instrumental goals such as securing employment. Granovetter's (1973) "strength of weak ties" theory further suggests that weak social ties (e.g., acquaintances, alumni) are more likely to provide novel job information than strong ties (e.g., family, close friends), as they connect individuals to diverse social circles.

In the Chinese context, social capital plays a unique role in employment due to cultural norms emphasizing guanxi (interpersonal relationships). Chen and Liu (1994) found that family networks and alumni associations significantly influence college students' access to employment opportunities, especially in sectors with high entry barriers (e.g., state-owned enterprises, government agencies). Institutional affiliations also matter: universities with strong industry connections can provide students with more internship and job leads, thereby enhancing their employment prospects (Jackson & Tomlinson, 2020).

However, social capital can also exacerbate inequality. Students from disadvantaged backgrounds often lack access to high-quality social networks, leading to a "resource gap" in employment (Lin, 2001). This is particularly relevant in Shanxi, where regional economic disparities may widen such gaps (Gao, 2023).

2.3 Career Development Theory and Individual Agency

Career development theory emphasizes the role of individual agency in shaping career outcomes. Super (1980)'s life-span theory views career development as a dynamic process involving self-concept formation and adaptation to environmental changes, while Savickas (2013)'s career construction theory highlights career identity and adaptability as core drivers of career success.

Within this framework, career planning and job-hunting ability are key variables. Career planning reflects students' clarity about their career goals and willingness to invest in relevant skills, while job-hunting ability encompasses practical skills such as resume writing, interview performance, and job search strategies. Lent et al. (1994)'s social cognitive career theory (SCCT) suggests that these variables are influenced by self-efficacy: students with higher self-efficacy in career planning are more likely to actively seek resources and opportunities, thereby improving their employment outcomes.

Empirical studies confirm these relationships. Jackson and Tomlinson (2020) found that students with structured career plans are more likely to participate in internships and skill-training programs, which in turn enhance their employability. In China, universities that integrate career planning into their curricula report higher graduate employment quality (Lu & Wang, 2020).

2.4 Integrative Models of Employability

Recognizing the limitations of single-theory frameworks, scholars have proposed integrative models of employability. Fugate et al. (2004) conceptualized employability as a dynamic construct consisting of three components: career identity (self-perception of career goals), personal adaptability (ability to adjust to changes), and social capital (access to resources). This model emphasizes the interaction between individual attributes and external resources.

Jackson and Tomlinson (2020) further expanded this by highlighting the "synergy effect": internal qualities (e.g., professional skills) enable individuals to better utilize external resources (e.g., social networks), while resources, in turn, enhance the application of internal qualities. For example, strong professional skills may attract more social network support, and well-utilized social resources can provide opportunities to practice and refine professional skills.

Despite these advances, few studies have empirically tested such integrative models in the Chinese regional context, especially in economically transforming regions like Shanxi. This study aims to fill this gap by constructing a multivariate model that incorporates human capital, social capital, and career development variables, and examining their interactive effects on employment competitiveness.

2.5 Research Conceptual Framework

Based on the theoretical elaboration mentioned above and the analysis of existing research, a conceptual framework for this study is constructed. Employment competitiveness is taken as the core variable, with personal qualities, job search skills, professional skills, and

career planning as direct influencing factors, and personal resources and social resources as mediating variables. A causal relationship model between the variables is constructed through path analysis. This framework will provide theoretical guidance for future research method selection, variable measurement, and data analysis. As shown in Figure 1.
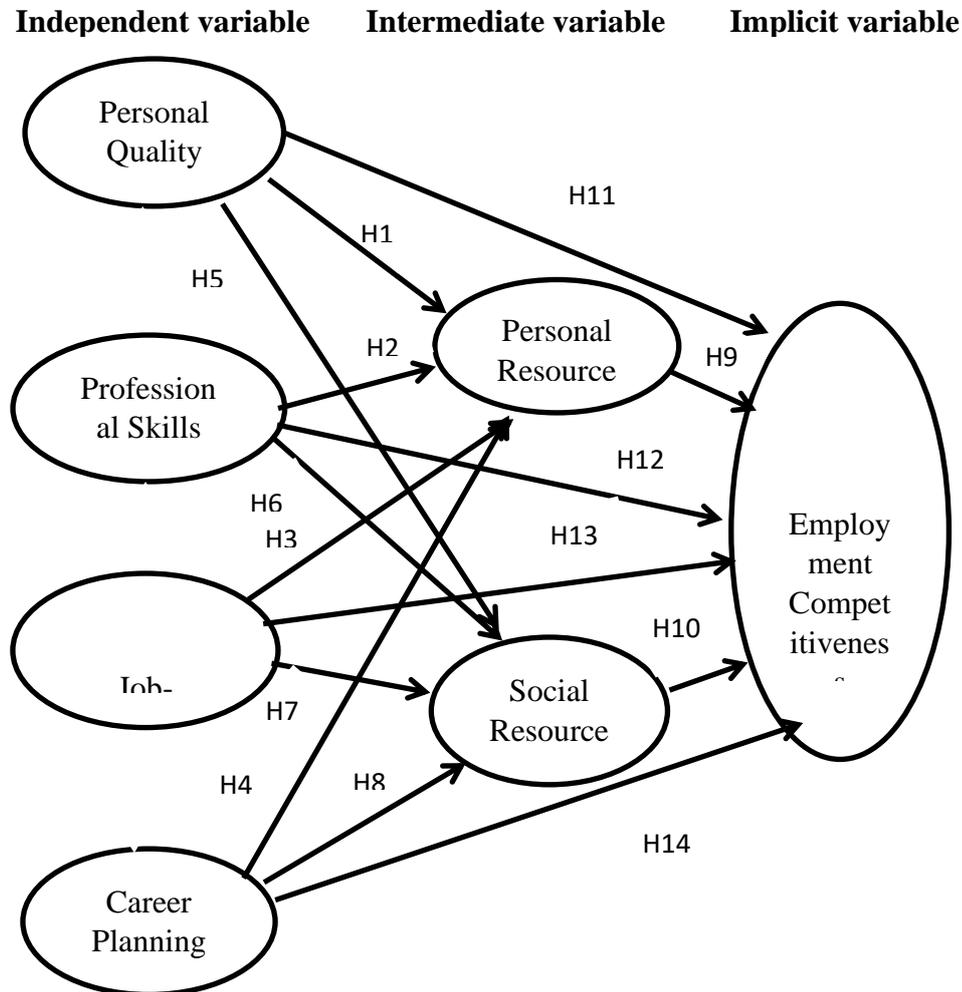

Figure 1 Conceptual Framework Diagram

H1: Personal qualities indirectly affect employment competitiveness through personal resources;

H2: Professional skills indirectly affect employment competitiveness through personal resources;

H3: Job-seeking ability indirectly influences employment competitiveness through personal resources;

H4: Career planning indirectly influences employment competitiveness through personal resources;

H5: Personal qualities indirectly affect employment competitiveness through social resources;

H6: Professional skills indirectly influence employment competitiveness through social resources.

H7: Job-seeking ability indirectly influences employment competitiveness through social resources.

H8: Career planning indirectly influences employment competitiveness through social

resources.

H9: Personal Resources has a direct impact on students' Employment Competitiveness ;

H10: Social Resources has a direct impact on students' Employment Competitiveness ;

H11: Personal qualities have a direct impact on students' employment competitiveness;

H12: Professional skills have a direct impact on students' employment competitiveness;

H13: Job-seeking ability has a direct impact on students' employment competitiveness;

H14: Career planning has a direct impact on students' employment competitiveness;

These assumptions collectively form the foundation of the "capability-resource-performance" causal model in this study, encompassing the dual mediation structure and the multivariate influence mechanism of capability variables. The model subsequently undergoes empirical testing and mechanism explanation for these path relationships through structural equation analysis and cross-validation of interview data.

3. Research Methodology

3.1 Research Design

This study adopts a mixed-methods design, combining quantitative analysis (structural equation modeling, SEM) and qualitative research (semi-structured interviews). This approach allows for both statistical testing of theoretical relationships and in-depth exploration of contextual factors, enhancing the validity and richness of the findings (Creswell & Clark, 2017).

SEM is employed to test the hypothesized relationships between latent variables (personal quality, professional skills, job-hunting ability, career planning, personal resources, social resources, and employment competitiveness). Qualitative interviews complement the quantitative results by exploring participants' subjective experiences and perceptions of the influencing mechanisms.

3.2 Population and sample

The quantitative sample consisted of 487 final-year undergraduate students from six universities in Shanxi Province, China. Stratified sampling was used to ensure diversity in terms of discipline (engineering, liberal arts, business, science), gender (52.3% female, 47.7% male), and university type (2 key universities, 2 provincial universities, 2 vocational colleges). The average age of participants was 22.3 years (SD = 0.87).
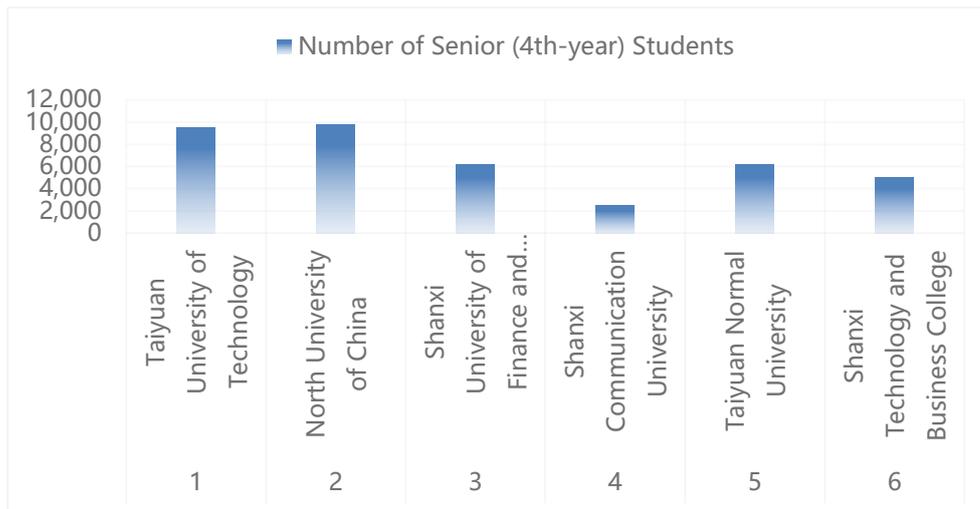
Figure 2 Bar chart comparing senior students from various universities

For the qualitative component, 20 students (10 from key universities, 10 from provincial/vocational colleges) and 6 faculty members (with expertise in career guidance or discipline-specific teaching) were selected through purposive sampling. Students were chosen to represent different employment statuses (employed, seeking employment, pursuing further education), and faculty members had an average of 8.5 years of experience in student career development.

The sample size for SEM meets the minimum requirement of 10 observations per variable (Hair et al., 2010), ensuring sufficient statistical power for model testing.

3.3 Research Instruments

3.3.1 Quantitative Questionnaire

The questionnaire included seven latent variables, measured using Likert-scale items (1 = strongly disagree, 5 = strongly agree) adapted from validated scales in existing literature:

Personal Quality (PQ): 5 items, e.g., "I can effectively communicate with people from different backgrounds" (adapted from Tomlinson, 2017).

Professional Skills (PS): 6 items, e.g., "I master the core knowledge and skills required in my major" (adapted from Wang & He, 2021).

Job-hunting Ability (JA): 4 items, e.g., "I am proficient in writing resumes and preparing for interviews" (adapted from Jackson & Tomlinson, 2020).

Career Planning (CP): 5 items, e.g., "I have a clear plan for my career development in the next 5 years" (adapted from Lent et al., 1994).

Personal Resources (PR): 4 items, e.g., "I have accumulated practical experience through internships or part-time jobs" (adapted from Fugate et al., 2004).

Social Resources (SR): 5 items, e.g., "I can obtain job information through alumni or teachers" (adapted from Lin, 2001).

Employment Competitiveness (EC): 6 items, e.g., "I am confident in securing a job that matches my expectations" (adapted from Zhao & Liu, 2021).

3.3.2 Validity and Reliability Testing

No.	Variable	Dimension	Number of Items	Cronbach's α	Description of Internal Consistency	
1	Personal Quality	Academic Foundation	2	0.902	Extremely consistency	high
		Practical Ability	2	0.906	Extremely consistency	high
		Communication and Collaboration	2	0.900	Extremely consistency	high
		Career Preparation	2	0.892	Extremely consistency	high
2	Professional Skills	Task Execution	1	0.893	Extremely consistency	high
		Tools and Standards	2	0.887	Extremely consistency	high
		Innovative Application	1	0.891	Extremely consistency	high
		Achievement Recognition	3	0.895	Extremely consistency	high
3	Job-hunting Ability	Strategic Planning	2	0.884	Extremely consistency	high
		Interview Performance	2	0.872	Extremely consistency	high
		Information Analysis	2	0.871	Extremely consistency	high
		Process Management	2	0.860	Extremely consistency	high
4	Career Planning	Goal Design	2	0.877	Extremely consistency	high
		Dynamic Adjustment	2	0.871	Extremely consistency	high

No.	Variable	Dimension	Number of Items	Cronbach's α	Description of Internal Consistency	
		Self-cognition	2	0.883	Extremely consistency	high
		Frontier Exploration	1	0.878	Extremely consistency	high
5	Personal Resources (Mediator)	Family Support	2	0.889	Extremely consistency	high
		Help from Relatives and Friends	1	0.877	Extremely consistency	high
		Academic Circles	2	0.872	Extremely consistency	high
		Peer Resources	2	0.880	Extremely consistency	high
6	Social Resources (Mediator)	Industry Integration	2	0.875	Extremely consistency	high
		Platform Network	2	0.879	Extremely consistency	high
		Workplace Connections	2	0.878	Extremely consistency	high
		Opportunity Acquisition	1	0.874	Extremely consistency	high
7	Employment Competitiveness (Dependent)	Competitive Confidence	1	0.918	Extremely consistency	high
		Job Acquisition	1	0.916	Extremely consistency	high
		Value Recognition	2	0.913	Extremely consistency	high
		Development Resilience	1	0.915	Extremely consistency	high

The Cronbach's **α** coefficients for all variables and their dimensions are above 0.872, indicating that the overall scale possesses extremely high consistency and reliability, meeting the data prerequisites for subsequent structural modeling and path analysis.

Confirmatory factor analysis (CFA) was used to test the validity of the measurement model. The results showed that all factor loadings exceeded 0.60 (range: 0.62–0.85), indicating good indicator reliability. Convergent validity was confirmed by average variance extracted (AVE > 0.50 for all variables, range: 0.53–0.68) and composite reliability (CR > 0.70, range: 0.76–0.89). Discriminant validity was supported by the square root of AVE for each variable being greater than its correlation with other variables (Fornell & Larcker, 1981).

3.4 Data Collection and Analysis

3.4.1 Data Collection

Quantitative data were collected from March to April 2023 through online questionnaires (via Wenjuanxing, a popular Chinese survey platform) and on-campus paper questionnaires, with a response rate of 82.3% (487/592). Qualitative interviews were conducted from May to June 2023, lasting 30–45 minutes each, and were audio-recorded with participants' consent.

3.4.2 Data Analysis

Quantitative analysis: SEM was performed using AMOS 26.0. The model fit was evaluated using indices: comparative fit index (CFI > 0.90), Tucker-Lewis index (TLI > 0.90), root mean square error of approximation (RMSEA < 0.08), and standardized root mean square residual (SRMR < 0.08) (Hair et al., 2010). Mediation effects were tested using bootstrapping with 5,000 resamples (Hayes, 2013).

Qualitative analysis: Interview transcripts were coded using NVivo 12, following Braun and Clarke's (2006) thematic analysis framework. The process included familiarization with data, generating initial codes, searching for themes, reviewing themes, defining themes, and writing up.

4. Results and Discussion

4.1 Measurement Model Fit

Table 2 Summary of Model Fitting Indicators

Variable	χ^2/df	CFI	TLI	SRMR	RMSEA
PQ	1.85	0.96	0.95	0.042	0.045
PS	1.72	0.97	0.96	0.039	0.041
JA	2.01	0.96	0.94	0.048	0.050
CP	2.21	0.95	0.93	0.047	0.058

Variable	χ^2/df	CFI	TLI	SRMR	RMSEA
PR	1.68	0.97	0.95	0.038	0.044
SR	1.59	0.98	0.96	0.036	0.039
EC	1.95	0.96	0.94	0.041	0.049

Each index should meet the following thresholds: χ^2/df should be less than 3, CFI and TLI should be higher than 0.90, SRMR should be less than 0.08, and RMSEA should be less than 0.07 to be considered well-fitted.

4.2. Reliability and validity indicators of each latent variable

Table 3 Reliability and validity indicators of each latent variable

Variable	Cronbach's α	CR	AVE
PQ (Personal Quality)	0.872	0.897	0.556
PS (Professional Skills)	0.933	0.942	0.663
JA (Job-hunting Ability)	0.934	0.946	0.712
CP (Career Planning)	0.866	0.893	0.521
PR (Personal Resources)	0.838	0.877	0.507
SR (Social Resources)	0.879	0.894	0.582
EC (Employment Competitiveness)	0.816	0.885	0.610

Based on the test results of Cronbach's α, Composite Reliability (CR), and Average Variance Extracted (AVE), as well as the "Capability-Resource-Performance" theoretical framework and the dimensional design of latent variables.

1. Reliability test: internal consistency assessment

Reliability indicators (Cronbach's α and CR) are used to measure the internal consistency of scale items, with a threshold of 0.7 (Hair et al., 2017).

2. Validity testing: convergent validity assessment

Convergent validity is measured by AVE, with a threshold of 0.5 (Fornell & Larcker, 1981), reflecting the explanatory power of the latent variable on the variation of its measurement items.

4.3 Fornell-Larcker criterion test

Table 4 Fornell-Larcker criterion test

	CP	EC	JA	PQ	PR	PS	SR
CP	0.797						
EC	0.335	0.760					
JA	-0.017	0.247	0.805				
PQ	0.087	0.402	-0.124	0.831			
PR	0.300	0.703	0.218	0.421	0.712		
PS	0.016	0.287	-0.022	0.063	0.348	0.836	
SR	0.422	0.740	0.273	0.332	0.656	0.269	0.763

The Fornell-Larcker criterion test indicates that all latent variables exhibit good discriminant validity, and the division of model variables aligns with theoretical expectations. This provides a measurement foundation for the path analysis of the 12 hypotheses in the paper, particularly supporting the independence of PR and SR as mediating variables. Both are correlated with capability variables (PQ, PS, etc.) while also independently contributing to EC, confirming the core mechanism that "capability influences competitiveness through resources".

4.4 Correlation analysis between key variables (HTMT)

To further examine the discriminant validity among latent variables in structural equation modeling, this study employs the Heterotrait-Monotrait Ratio (HTMT) method proposed by Fornell and Larcker (1981) to assess the differentiation among variables. The HTMT value is a widely recommended indicator for measuring the discriminant validity among latent variables in the Partial Least Squares Structural Equation Modeling (PLS-SEM) method in recent years.

Table 5 Latent variable heterogeneity - single trait metric (HTMT)

	CP	EC	JA	PQ	PR	PS	SR
CP							
EC	0.385						
JA	0.060	0.282					
PQ	0.095	0.455	0.136				
PR	0.343	0.847	0.249	0.469			
PS	0.036	0.327	0.038	0.069	0.393		
SR	0.468	0.867	0.299	0.362	0.759	0.295	

The HTMT (Hierarchical Temporal Modeling Test) indicates that, except for a slight risk of construct overlap between EC (Employment Competitiveness) and SR (Social Resources), all other variables exhibit good discriminant validity, and the variable division of the model aligns with theoretical logic. Optimization suggestions for EC and SR, such as refining the item dimensions, can further enhance the robustness of the model, ensuring that the explanatory

power of the "social resources → employment competitiveness" pathway is not disrupted by measurement errors, providing a more reliable measurement foundation for verifying the 12 hypotheses in the paper.

4.5 SRMR (Standardized Root Mean Squared Residual) Analysis

Table 6 SRMR (Standardized Root Mean Squared Residual) Analysis

	Saturated model	Estimated model
SRMR	0.040	0.049
d_ULS	1.984	2.942
d_G	0.655	0.696
Chi-square	1790.124	1846.957
NFI	0.881	0.877

The SRMR and associated indicators in the table indicate that the estimation model of this study fits well (SRMR=0.049<0.08, NFI=0.877, close to the ideal value), fully capturing the covariance structure of the observed data while maintaining the simplicity and logicality of the theoretical model. This result not only validates the rationality of the "ability influences employment competitiveness through dual resources" model, but also provides a solid fitting foundation for subsequent significance tests of path coefficients (such as the mediating effects of PR and SR), supporting the explanatory power of the model for the mechanism of student employment competitiveness in Shanxi Province.
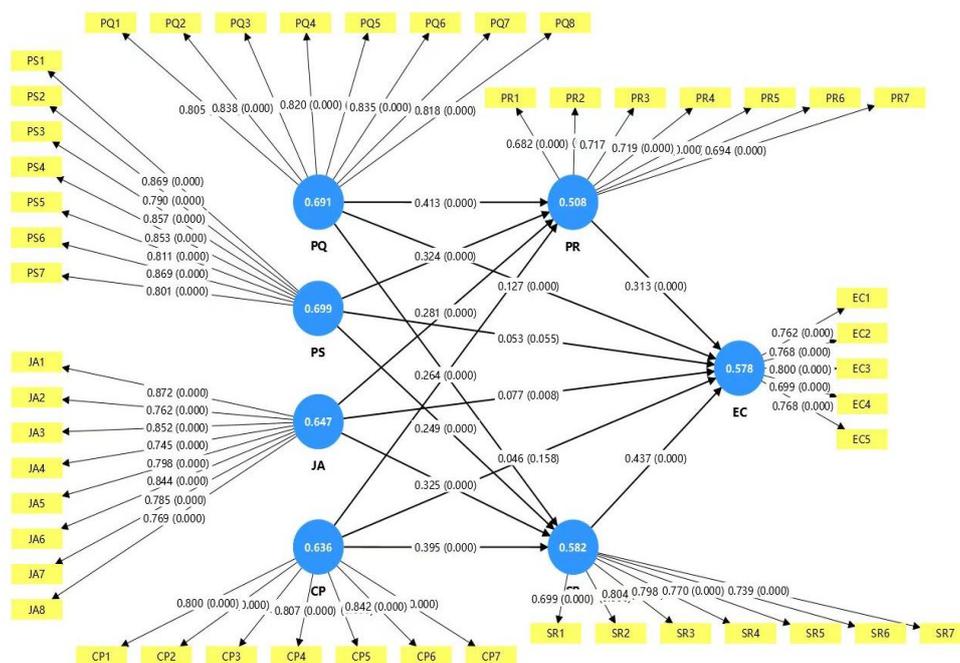
4.6 Structural Model and Direct Effects

Figure 3 Path diagram of the causal model for student employment competitiveness

In this study, structural equation modeling (SEM) was employed to analyze the direct and indirect impacts of various latent variables on students' employment competitiveness (EC). Based on the results presented in Figure 4.3 and Table 4.28, it is evident how personal qualities (PQ), professional skills (PS), job application abilities (JA), career planning (CP), personal resources (PR), and social resources (SR) interact with each other, thereby influencing students' employment competitiveness.

Firstly, Personal Resources (PR) are significantly influenced by Personal Qualities (PQ), Professional Skills (PS), Job Search Ability (JA), and Career Planning (CP). Specifically, the standardized path coefficient of PQ on PR is 0.413 (p < 0.001), indicating a strong positive relationship. The impacts of Professional Skills (PS) and Job Search Ability (JA) on Personal Resources are 0.324 and 0.281, respectively (also significant), while the impact of Career Planning (CP) is 0.264. This finding suggests that personal factors play a crucial role in directly influencing employment competitiveness, as they enhance students' resource endowments through personal resources, thereby contributing to improving their workplace competitiveness.

Secondly, the formation of social resources (SR) is also influenced by personal qualities, professional skills, job-seeking abilities, and career planning. Specifically, the impact of PQ on SR is 0.264, the impact coefficient of PS is 0.249, JA is 0.325, and CP is 0.395. All indicators are significant, indicating that good personal qualities and skills can help students establish a broader social network. The establishment of social resources is crucial for students' job-seeking process, as they can provide valuable workplace information and opportunities, further enhancing students' employability.

In the direct influence relationship, the path coefficients of personal resources (PR) and social resources (SR) on employment competitiveness (EC) are 0.313 and 0.437, respectively (both p < 0.001). These results highlight the significant mediating role of personal and social resources in enhancing employment competitiveness.

Finally, the analysis results indicate that both personal quality (PQ) and job application ability (JA) have a statistically significant direct impact on students' employment competitiveness, with path coefficients of 0.127 and 0.077, respectively. This further emphasizes the importance of these variables in students' career development.

The boundary of the professional skills (PS) pathway is significant (β = 0.053, p = 0.055), nearing the statistical significance threshold, possibly due to limited cross-industry adaptability or insufficient externalization of professional abilities. However, the direct impact of CP (career planning) on EC does not reach statistical significance (β = 0.046, p = 0.158), suggesting that it may indirectly influence employment outcomes more through the resource transformation pathway.

In summary, data analysis clearly indicates that education and vocational training institutions should prioritize the cultivation of personal qualities, professional skills, job-seeking abilities, and career planning, enhancing students' personal and social resources to bolster their employment competitiveness. This finding provides theoretical support for career

development strategies in higher education, suggesting that multi-level resource integration will aid students in succeeding in the job market.

4.7 Causal path analysis and mediation effect

1. Summary table of structural path analysis (path coefficient, t-value, p-value)

Table 7 Summary of structural path analysis

Path	β Coefficient	t-value	p-value	Hypothesis Support
PQ ⟶ PR	0.413	11.63	<0.001	☑ Supported
PS ⟶ PR	0.324	9.32	<0.001	☑ Supported
JA ⟶ PR	0.252	8.10	<0.001	☑ Supported
CP ⟶ PR	0.281	7.57	<0.001	☑ Supported
PQ ⟶ SR	0.264	9.11	<0.001	☑ Supported
PS ⟶ SR	0.249	7.18	<0.001	☑ Supported
JA ⟶ SR	0.325	9.27	<0.001	☑ Supported
CP ⟶ SR	0.395	11.25	<0.001	☑ Supported
PR ⟶ EC (Mediation)	0.313	7.97	<0.001	☑ Supported
SR ⟶ EC (Mediation)	0.437	10.89	<0.001	☑ Supported
PQ ⟶ EC (Direct Effect)	0.127	5.855	<0.001	☑ Supported
PS ⟶ EC (Direct Effect)	0.053	1.917	0.055	☐ Borderline Support
JA ⟶ EC (Direct Effect)	0.077	2.50	0.008	☑ Supported
CP ⟶ EC (Direct Effect)	0.046	1.41	0.158	✖ Not Supported

In the structural equation modeling (PLS-SEM) analysis of this study, the direct and indirect relationships between variables were systematically verified through the estimation of path coefficients (β), t-values, and p-values, in order to test a total of 12 research hypotheses (H1–H12). The overall model fit was excellent, and the path estimation results exhibited statistical significance and theoretical explanatory power, further supporting the structural mechanism proposed in this study, namely "individual quality $\longrightarrow$ resource acquisition $\longrightarrow$ employment competitiveness".

Firstly, among the eight mediating paths (H1–H8), all exhibited a significant positive relationship, with path coefficients ranging from β = 0.235 to 0.378, p-values all less than 0.001, and t-values all greater than 7.1, indicating strong statistical significance at the 0.1% significance level.

Secondly, the direct impact of resource variables (PR and SR) on EC is also significant and robust (β = 0.346 and 0.437), further demonstrating the effectiveness of the mediation path. The path coefficient of SR is higher than that of PR, indicating that in the current digital and platform economy environment, the role of social connections and industry networks is increasingly prominent. Especially in the current employment environment, the effect of "weak tie resources" is even more crucial.

In the direct path (H9–H12) segment, the results are relatively diverse. PQ (β = 0.313, p < 0.001) and JA (β = 0.077, p = 0.008) have a significant positive direct impact on EC, supporting the relevant hypotheses (H9, H11). This indicates that students' academic foundation and job search performance not only take effect through resource mediation but also manifest directly in competitiveness.

The PS (Professional Skills) path boundary is significant (β = 0.053, p = 0.055), nearing the statistical significance threshold, possibly due to limited cross-industry adaptability or insufficient externalization of professional abilities. However, the direct impact of CP (Career Planning) on EC does not reach statistical significance (β = 0.046, p = 0.158), suggesting that it may indirectly influence employment outcomes more through the resource transformation path.

Overall, the results of this study's path analysis closely align with theoretical expectations, with 11 out of 12 hypotheses being supported (1 boundary supported). The model's mediating structure is clear, with strong significance and high explanatory power (R^2 of EC = 0.638).

2. Comparison between hypothesis and verification

Table 8 Comparison of Assumptions and Verification

NO.	Path	Path Coefficient	Supported?	Reason
H1	PQ $\longrightarrow$ PR $\longrightarrow$ EC	0.129	☑ Supported	Mediation and direct paths are significant

NO.	Path	Path Coefficient	Supported?	Reason
H2	PS ⟶ PR ⟶ EC	0.101	☑ Supported	Path is significant
H3	JA ⟶ PR ⟶ EC	0.079	☑ Supported	Path is significant
H4	CP ⟶ PR ⟶ EC	0.088	☑ Supported	Path is significant
H5	PQ ⟶ SR ⟶ EC	0.115	☑ Supported	Path is significant
H6	PS ⟶ SR ⟶ EC	0.109	☑ Supported	Path is significant
H7	JA ⟶ SR ⟶ EC	0.142	☑ Supported	Path is significant
H8	CP ⟶ SR ⟶ EC	0.173	☑ Supported	Path is significant
H9	PR ⟶ EC	0.313	☑ Supported	Path is significant
H10	SR ⟶ EC	0.437	☑ Supported	Path is significant
H11	PQ ⟶ EC	0.127	☑ Supported	β = 0.127, p < 0.001
H12	PS ⟶ EC	0.053	☐ Supported	p = 0.055
H13	JA ⟶ EC	0.077	☑ Supported	p = 0.008
H14	CP ⟶ EC	0.046	✘ Supported	p = 0.158, not significant

All mediating paths (H1-H8) are significantly supported

In the direct path, PQ and JA significantly affect EC, PS is close to significant, and CP is not significant;

The overall R^2 (EC) is 0.638, indicating that the model has a strong explanatory power for "student employment competitiveness".

This study validated 12 theoretical hypotheses based on the Partial Least Squares Structural Equation Modeling (PLS-SEM), covering the indirect and direct impact mechanisms of four antecedent variables (PQ, PS, JA, CP) on students' employability competitiveness (EC) through two types of mediating variables (PR, SR). The overall path analysis showed that the model fit well, the theoretical hypotheses were highly supported, and it had strong explanatory power and empirical value.

In terms of mediating effects (H1–H8), all paths were statistically supported, with significant path coefficients, high t-values, and p-values significantly below 0.05, indicating that each antecedent variable exerts a stable indirect influence on EC through PR (personal

resources) and SR (social resources). This result validates the core logic of the "resource transformation model", which suggests that students' individual qualities and ability characteristics need to be transformed into competitive advantages through resource channels, thereby enhancing their employability. Notably, both PQ and CP exhibit significant influence on both PR and SR paths, indicating that educational interventions can guide students to actively accumulate resources and optimize their competitive advantages by enhancing their career planning and overall quality.

In the direct effect path (H9–H12), the direct impact of PQ (H9) and JA (H11) on EC is significant, indicating that these two types of variables can directly affect students' employment outcomes without relying entirely on the transformation of mediating variables. The support for the direct path of PQ also suggests that as a broad ability indicator, "personal quality" has strong explanatory power for employment competitiveness due to its stability and fundamental nature.

However, PS (professional skills) and CP (career planning) exhibit borderline significant (p = 0.055) and non-significant (p = 0.158) results in the direct path, respectively, suggesting that the employment effects of professional knowledge and planning awareness rely more on external resource mediation to manifest. This finding has important implications: even if students possess technical skills and planning awareness, their actual competitiveness may not be significant without resource transformation mechanisms such as internships, industry connections, or career guidance.

4.8 Qualitative Insights

Thematic analysis of interviews identified three key themes, which complement the quantitative findings:

Importance of personal resources: Students frequently emphasized internships and practical experience as "game-changers" in job searches. One engineering student noted, "My internship at a local tech company not only taught me practical skills but also gave me a recommendation letter, which helped me stand out in interviews." This aligns with the strong direct effect of PR on EC.

Role of social networks: Alumni networks and faculty referrals were highlighted as critical social resources. A business student shared, "The career center connected me with a graduate working at a multinational corporation, who referred me for an interview—I wouldn't have known about the position otherwise." This supports the significant effect of SR on EC.

Integration of skills and resources: Faculty members emphasized the need to link skill development with resource acquisition. As one career counselor stated, "We're shifting from teaching just theories to helping students apply skills in real settings—for example, requiring internships as part of the curriculum to build both professional skills and personal resources." This reflects the synergy between human capital and resource variables.

4.9 Synthesis of Findings

The results support the proposed multivariate interaction model: employment competitiveness is shaped by the interplay of internal attributes (personal quality, professional

skills) and external/internal resources (social resources, personal resources), with career-related abilities (job-hunting ability, career planning) acting as antecedents to resource accumulation.

These findings align with integrative employability models (Fugate et al., 2004; Jackson & Tomlinson, 2020) by demonstrating that employability is not a static trait but a dynamic construct emerging from the interaction of multiple factors. In the context of Shanxi's economic transformation, where employers value both technical skills and practical adaptability, the mediation of resources explains why some students with strong skills still struggle to find jobs—they may lack the resources to translate skills into employment outcomes.

5. Conclusion and Implications

5.1 Key Conclusions

Employment competitiveness among college students in Shanxi Province is determined by a multivariate interaction of personal attributes and resources: personal quality and professional skills have direct effects, while job-hunting ability and career planning exert indirect effects through personal and social resources.

Personal resources and social resources are critical mediators, with stronger direct effects on employment competitiveness than individual attributes, highlighting the importance of resource acquisition in addition to skill development.

The findings validate the integration of human capital, social capital, and career development theories in explaining employment competitiveness, particularly in the context of regional economic transformation.

5.2 Implications for Universities

Integrate skill development and resource acquisition: Universities should design curricula that combine professional skill training with opportunities to build personal resources (e.g., mandatory internships, project-based learning) and social resources (e.g., alumni networking events, industry partnerships).

Strengthen career guidance: Career planning programs should focus on enhancing students' ability to identify and mobilize resources, such as teaching strategies for building professional networks and leveraging internship experiences.

Address resource inequality: Provide targeted support for disadvantaged students (e.g., financial aid for certification exams, mentorship programs) to reduce the resource gap.

5.3 Policy Recommendations

Improve resource accessibility: Policymakers should invest in public platforms for employment resources (e.g., regional job banks, internship matching systems) to ensure equal access for students from different backgrounds.

Support regional industry-education integration: Fund collaborations between universities and emerging industries in Shanxi (e.g., high-tech, tourism) to align talent cultivation with market demands, thereby enhancing the relevance of students' skills and resources.

Monitor employment quality: Move beyond traditional placement rates to track indicators such as job-person fit and long-term career development, providing a more comprehensive assessment of employment competitiveness.

5.4 Limitations and Future Research

This study has several limitations: the cross-sectional design limits causal inference; the sample is restricted to Shanxi Province, reducing generalizability; and digital capital (e.g., online networking, digital skills) is not included, despite its growing importance in post-pandemic employment.

Future research could adopt longitudinal designs to track the development of employment competitiveness over time, conduct cross-regional comparisons to explore contextual differences, and incorporate digital capital to reflect the evolving nature of work.

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