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ORIGINAL CONTRIBUTION

Predicting Undergraduates' Perceived Employment Competitiveness: The Interplay of Learning Environment, School–Enterprise Cooperation and Student Motivation

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Abstract— The ability of graduates to find jobs is a key measure of the quality of education. The present study investigates structural relationships of Learning Environment (LE), Student Motivation (SM), School-Enterprise Cooperation (SEC), and Perceived Employment Competitiveness (EC) in an application-oriented university in China. Data were collected from 956 third and fourth year undergraduates through a quantitative cross-sectional survey design and selected using stratified random sampling. Data were analyzed using descriptive statistics, Pearson correlation, multiple regression analysis and Partial Least Square Structural Equation Modeling (PLS-SEM). The study found that the LE, SEC, and SM were all positively related to undergraduates' assessed Employment Competitiveness (EC). In the structural model, school-enterprise cooperation had the greatest positive direct association with perceived EC, followed by student motivation. However, the LE had no statistically significant direct influence. The indirect pathways analysis showed that the LE was strongly related to perceived EC through both SEC and SM. These findings suggest that the LE may largely serve as a supportive background for perceived EC by encouraging SEC and SM, rather than directly impacting it. The study contributes to the employability literature by integrating institutional and psychological perspectives in application-oriented higher education.

Index Terms— Employment competitiveness, Learning environment, School–enterprise cooperation, Student motivation, Universities with an application-oriented mission

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Introduction

Career readiness among graduates has become one of the most crucial requirements in the ever-changing industrial landscape for both prospective workers and recruiters. Employers today prioritize candidates' dedication to lifelong learning and adaptability to changing organizational and technical settings, in addition to good academic performance (Vázquez-Rodríguez et al., 2025). This increased emphasis on adaptation underscores the need for institutions to bridge the gap between academic education and industry by equipping graduates with skills applicable to professional contexts (Hisa et al., 2024). Employability is not only critical to graduates' future career paths but also an indicator of how universities contribute to socio-economic development. Graduate Capital Theory states that employability develops through the accumulation of multiple forms of capital, such as human, social, and psychological capital, during the tertiary education process (Tomlinson, 2017). Social Cognitive Career Theory (SCCT), by contrast, focuses on the dynamic relationship between institutional support systems, personal characteristics, and career criteria, with institutional context and personal motivation as critical joint motivators (Lent et al., 1994). The Career EDGE model, in its turn, defines

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employability as a developmental concept attained through academic knowledge, practical experience, transferable skills, and reflective learning (Dacre Pool & Sewell, 2007). Thus, graduates' employability depends on the combined impact of the above-mentioned factors.

Although prior research has highlighted the Learning Environment (LE), School-Enterprise Collaboration (SEC), and student enthusiasm as major predictors of educational and professional outcomes, extant knowledge remains fragmented. Firstly, current research usually assesses these components separately and ignores their joint effect on graduates' employment prospects. Second, few studies examine the relationship between institutional determinants, including university-enterprise connections, and personal psychological components, including academic motivation. Third, although recent foreign researchers Hisa et al. (2024) and Vázquez-Rodríguez et al. (2025) emphasize the need to develop a multidimensional model of employability, data on universities within applied purposes remain insufficient

To bridge these gaps, this study uses a theoretical framework that synthesizes the research variables. These variables combine Human Capital Theory (HCT), Situated Cognition Theory (SCT), Synergy Theory (ST), and Self-Determination Theory (SDT). Human Capital Theory provides the basic framework for explaining how investment in education develops employability competencies. Situated Cognition Theory explains how employability competencies develop through socially situated learning. In contrast, Synergy Theory explains value development through collaboration between schools and enterprises, bridging the gap between academic success and business organizations' requirements.

In light of this, the current study investigates how undergraduates at Chinese universities with an application-oriented mission view their employment competitiveness in relation to the learning environment, educational entrepreneurial collaboration, and student motivation. The study intends to advance employability theory and higher education practice by integrating institutional and psychological viewpoints into a cohesive framework.

Problem statement

Despite reforms in Chinese higher education, structural issues persist that hinder students'employment competitiveness, especially at non-selective and private universities. Conventional teacher-centered and examination-oriented instruction remains prevalent across many tertiary institutions (H. Zhang et al., 2023). Consequently, these conventional teaching paradigms fail to align with the dynamic requirements of today's knowledge-driven digital marketplace. While digital technologies were introduced in certain institutions, their use has mainly centered on content delivery and not on facilitating interactive learning, creativity, and real-world problem-solving; therefore, in the digital age, traditional teaching methodology does not seem to be able to keep pace with the new dynamics of the digital and knowledge economy. Recent studies in Chinese private universities show that students' engagement with learning environments is influenced by interpersonal connections, meaningful participation in learning activities, and the quality of teacher-student interactions, in addition to access to educational resources (Yang et al., 2025; Yang et al., 2026). Nevertheless, students tend to focus more on theoretical knowledge acquisition and lack practice in interdisciplinary, collaborative, and problem-solving competencies, which are essential for modern jobs (Lan et al., 2024; Ni et al., 2025).

Second, as school–enterprise cooperation is a well-encouraged strategy in China to promote graduates' employability, its application is not uniform across higher education institutions. SEC initiatives in many application-oriented universities are shallow, sporadic and unsustainable due to fuzzy objectives, poor institutional frameworks and limited corporate engagement incentives. Therefore, students often lose the opportunities to gain structured work experience and mentorship from the industry which results in an even larger gap between academic preparation and the labor market expectations..

Third, student motivation represents another critical factor. Many students have low intrinsic motivation, poor self-regulation, and limited career-planning skills. Studies suggest that many Chinese university students are influenced more by external factors than by their own interests or long-term professional goals. These incentives include academic results and the expectations of parents and teachers. This low internal motivation could restrict students' participation in active learning and their ability to cultivate employability skills such as persistence, communication, and self-management (Chujing et al., 2025). Together, LE, SEC, and learners' motivation are the three main variables linked to employment efficiency. As such, studying how these factors work together is theoretically and practically relevant to undergraduate employability.

Research objectives

The following particular goals are the focus of the study:

i) To examine the relationship between the learning environment, school–enterprise cooperation, student motivation and undergraduates' perceived employment competitiveness.

ii) To investigate the predictive contributions of the learning environment, school–enterprise cooperation and student motivation to undergraduates' perceived employment competitiveness.

iii) To examine the indirect associations between the learning environment and undergraduates' perceived employment competitiveness through school–enterprise cooperation and student motivation.

Research questions

Based on the objectives outlined, the following research questions and hypotheses will be tested in the current research:

Q1. What is the relationship between the learning environment, school–enterprise cooperation, student motivation, and undergraduates' perceived employment competitiveness at Qingdao Hengxing University?

Q2. To what extent do the learning environment, school–enterprise cooperation, and student motivation predict undergraduates' perceived employment competitiveness at Qingdao Hengxing University?

Q3. To what extent is the learning environment indirectly associated with undergraduates' perceived employment competitiveness through school–enterprise cooperation and student motivation at Qingdao Hengxing University?

Hypotheses of the study

H1: Based on Situated Cognition Theory, the learning environment is significantly and positively associated with undergraduates' perceived employment competitiveness.

H2: Based on Synergy Theory, school–enterprise cooperation is significantly and positively associated with undergraduates' perceived employment competitiveness.

H3: Based on Self-Determination Theory, student motivation is significantly and positively associated with undergraduates' perceived employment competitiveness.

H4: The learning environment, school–enterprise cooperation, and student motivation jointly predict undergraduates' perceived employment competitiveness.

H5: Learning environment is indirectly associated with undergraduates' perceived employment competitiveness through school–enterprise cooperation.

H6: Learning environment is indirectly associated with undergraduates' perceived employment competitiveness through student motivation.

Literature Review

Learning environment and employment competitiveness of undergraduates

Situated Cognition Theory is a relevant theory that helps to explain how to design spaces that foster learning. This theory assumes that knowledge and learning are inherently social and context-dependent (Brown et al., 1989). Learning in this sense cannot become detached from other forms of practice and from social environments (Brown et al., 1989). This view of learning reiterates the need to design real learning environments that match the job tasks workers face in the workplace (Kenaphoom & Niyomves, 2023). From this perspective, high-quality learning experiences are critical for developing job-related skills, including communication, cooperation, adaptability, and problem-solving.

Across different higher education systems, the learning environment has repeatedly been identified as an essential contextual determinant affecting learners' academic engagement, skill development, and employability. Studies in the United Kingdom, Australia, and the United States suggest that authentic learning environments, collaborative pedagogies, and industry-oriented curricula contribute positively to students' readiness for future careers (Healy, 2023; Jackson & Bridgstock, 2020; Ornellas et al., 2019).

A learning environment includes not only physical infrastructure and pedagogical practices but also social behaviors and organizational culture. These factors interact to support students' ability to integrate knowledge and skills throughout their academic lives (H. Zhang et al., 2023). Learning experiences that mirror workplace experiences (group projects, client-based assignments, digital simulations) build students' confidence and help them gain the skills needed to succeed in the workplace. Such experiential learning opportunities are argued to be vital for bridging the gap between classroom theory and practice and contribute to students' competitiveness in the labor market (Choi-Lundberg et al., 2024). Despite extensive research on the role of learning environments in acquiring employable competences, findings to date indicate that these influences are not necessarily direct. Scholars such as Widiyanti et al. (2020) suggested that direct influences of learning environments on employability were minimal, although mediated (More specifically, through learning engagement and academic outcomes). They emphasized the significance of mental and performance factors as mediators between the environment and employability outcomes. Consistent with Chigbu and Nekhwevha (2022), evidence for a direct relationship between physical learning spaces and employability outcomes remains lacking. They also found that to achieve meaningful gains in employability, environmental design must be linked to appropriate teaching strategies and relevant learning activities. Authentic learning activities can help bridge the gap between knowledge and practice. Knowledge learned through activity-based or culturally significant learning can be applied in real-life situations, making learning more meaningful (Fong et al., 2025). According to Shin and Idang (2025), activities that incorporate real-life situations further enhance the relevance of education by prompting students to use their problem-solving skills in practical scenarios.

Although findings from Europe, Australia, and Asia generally support the positive role of learning environments, the magnitude and pathways of these effects remain inconsistent across different educational contexts. Some studies found positive relationships between learning environments

and students' communication skills, teamwork abilities, and problem-solving competencies. Other studies found these relationships were not statistically significant or suggested that learning environments' effects were mainly mediated by mechanisms such as career development learning, internship experiences, and industry-academia collaborations (Chigbu & Nekhwevha, 2022; Jackson et al., 2024). These inconsistent results suggest that the learning environment may be a contextual or enabling factor rather than a direct predictor of employability. Moreover, earlier research suggests that school–enterprise cooperation and students' motivational engagement can enhance the effect of the learning environment, implying its role as an instrumental contextual force in an integrated employability framework.

To address these inconsistencies, the present study incorporates LE, SEC, and SM into a unified theoretical framework. By examining these factors simultaneously, the research aims to provide broader insight into how education contributes to students' EC.

School–Industry collaboration and undergraduates' employability

Across higher education systems worldwide, collaboration between universities and industry has become an important strategy for enhancing graduates' employability by narrowing the gap between academic preparation and labor market requirements. Countries have developed distinct university-industry collaboration models, including Germany's Dual System, the United Kingdom's placement programs, Australia's Work-Integrated Learning (WIL), and Canada's cooperative education (Co-op) model. Although these approaches differ in implementation, they share the objective of strengthening students' workplace readiness through authentic engagement with industry.

SEC has gained significant attention as a key strategy to mitigate career pressure in higher education, especially at applied universities. In 2023, China's nationwide university graduate figures surged past 11 million, according to Ministry of Education records. As a result, the sheer volume of graduates is growing exponentially, making it even harder for universities to ensure adequate graduate employment quality. However, numerous businesses report a significant gap between the skills individuals acquire and those needed in professional workplaces. In particular, newly recruited graduates are often seen as lacking practice-oriented skills and a less robust professional identity (Sá & Serpa, 2018).

Synergy Theory provides a foundational theoretical lens for analyzing the collaborative mechanics of university-industry linkages. The core premise is that cohesive interactions across distinct operational systems yield a combined output that surpasses the sum of individual contributions. In school-enterprise partnerships, stronger academic-industry synergy is essential to reconcile traditional instruction with current market demands (X. Chen & Li, 2025; Y. Zhang & Chen, 2023). From the perspective of Synergy Theory, these international collaboration models demonstrate that sustainable partnerships between universities and industry generate complementary resources that neither party can achieve independently.

Research on Germany's Dual System consistently demonstrates that close collaboration between vocational institutions and enterprises improves graduates' practical competencies and facilitates smoother school-to-work transitions (Busemeyer & Trampusch, 2011; Euler et al., 2013). Similarly, studies in the United Kingdom show that placement learning enhances students' professional identity, transferable skills, and graduate employment outcomes (Jackson, 2014). In Australia, Work-Integrated Learning (WIL) is widely acknowledged as an effective approach to developing workplace readiness through learning experiences grounded in authentic practice and industry engagement (Smith, 2012; Smith & Worsfold, 2013).

Most research to date shows that educational entrepreneurial collaboration improves students' employability and efficiency in the job market. Through specialized projects, co-operative education programs, internships, and workplace learning experiences, students can acquire professional knowledge, gain practical skills, and improve their readiness for workplace needs. The impact of these factors varies by context, depending on the nature of cooperation between schools and industries. According to research, the interaction between schools and enterprises is most effective when industry participation is an integral part of the process of curricular and talent development.

However, prior scholarship has identified several disadvantages to this collaboration. In relation to SEC, results largely depend on the level and quality of the university-industry cooperation. At times, the partnership is superficial. For instance, internships may lack clear learning objectives and may not be well integrated into the degree program. This fragmented process reduces students' chances of acquiring the competencies the job market requires. However, studies in Europe and Australia indicate that successful university-industry cooperation requires high-quality cooperation, curricular integration, and workplace supervision.

Furthermore, through SEC, it is possible for employers to benefit not only from increased practical skills of the learners but also to influence the job competitiveness of the learners through enhanced motivation of the learners. This suggests that understanding the SEC must be grounded in an embedded system that uses context and psychological processes to improve employability outcomes. These collaborations contribute to educational policies and regional innovation systems (Lian et al., 2024; Zhuang & Zhou, 2022). These collaborations not only improve the institutional reputation of the higher education institutions but also help to build stronger relationships between academia and industry. Employers benefit by accessing talent early and fulfilling their corporate social responsibilities.

Overall, existing studies consistently recognize the value of collaboration between universities and industry in enhancing graduates' employability. Nevertheless, prior scholarship has mainly examined these collaborative models independently, with limited attention devoted to how school–enterprise cooperation interacts with learning environments and students' motivation to shape perceived employment competitiveness, particularly within Chinese universities with an application-oriented mission.

The employment competitiveness of undergraduates in relation to students' motivation

Throughout global tertiary systems, academic context consistently emerges as a crucial situational element shaping student involvement, competency building, and overall job readiness. Empirical literature from Western jurisdictions indicates that experiential educational settings, team-based instructional strategies, and career-aligned learning significantly bolster graduates' preparedness for future careers (Di Domenico & Ryan, 2017; Lent & Brown, 2013; Ryan & Deci, 2020).

Academic drive serves as a fundamental psychological determinant of an undergraduate's career readiness. Learners possessing higher self-determination, specifically intrinsic interest and self-aligned goals, tend to proactively commit to career-building pursuits (including practical training, placement opportunities, and strategic career mapping) compared to those driven solely by external incentives (Li et al., 2022; Yang et al., 2025). Through continuous active learning, students naturally cultivate lifelong traits such as initiative, resilience, flexibility, and critical thinking. These abilities are commonly considered essential to work readiness and a crucial component of training graduates for the ever-changing labor market.

Evidence from Chinese private higher education further supports the importance of motivation in shaping students' active involvement in learning. In a Chinese private university, Yang et al. (2026) found that learning motivation significantly explained classroom involvement. This suggests that motivated students are more likely to participate actively in educational experiences. Such engagement may provide an important behavioral foundation for the subsequent development of employability-related competencies.

SDT of (Deci & Ryan, 1985) can serve as an excellent theoretical basis for understanding how motivation affects the readiness for future careers among students. According to Self-Determination Theory, intrinsic motivation arises from fulfilling three fundamental psychological needs (autonomy, competence, and relatedness); as a result, learning is inherently interesting. In addition, the research aligns with findings that more autonomous students Li et al. (2022) are not only more career-driven, self-effective, and motivated but also more future-oriented and, therefore, develop better employability (Li et al., 2022). Beyond Self-Determination Theory, Social Cognitive Career Theory (SCCT) explains how individual factors (self-efficacy and motivation), alongside environmental supports, affect career development and work responsibilities. According to Social Cognitive Career Theory, students with motivational beliefs tend to explore careers, develop skills, and make career decisions, thereby improving their employability (Lent & Brown, 2013).

Motivational resources have also been considered important in other Chinese educational contexts, where motivation-related constructs are reliable and valid and have explained significant variance in educational engagement and achievement (Jie & Shin, 2026). However, the nature and extent of the link between motivation and employability remain debatable, despite empirical studies clearly supporting both concepts and their connection. For instance, learning engagement and dedication to career preparation have been demonstrated to be positively correlated with intrinsic motivation (Di Domenico & Ryan, 2017). While external pressures (e.g., academic commitments) may boost short-term job performance, they may not promote the persistence, creativity, and proactive career behaviors required in a more competitive labor market (Lisá et al., 2023; Parker et al., 2010). Not all forms of motivation contribute equally to job competition, and quality may matter more than potency alone.

It has also been suggested that motivation does not influence employability by itself, but through a combination of psychological and behavioral factors that shape employment outcomes. For example, self-efficacy, career adaptability, and achievement motivation are among other factors that mediate motivation and employability findings. Indeed, students who feel more confident in their self-efficacy are more likely to search for work, take on more difficult tasks, interview better, and receive better evaluations (Mahfud et al., 2024). Taken together, these results imply that motivation affects employment competitiveness by increasing psychological resources for career-relevant behavior.

Although earlier research has consistently identified motivation as an important predictor of employability, comparatively fewer studies have examined motivation within an integrated analytical framework that simultaneously considers educational context and institutional support. As a consequence, the interaction between LE, SEC, and SM remains insufficiently explored, particularly in universities with an application-oriented mission.

Theoretical framework that integrates the study variables and research novelty

Preparing graduates for increasingly complex and rapidly changing labor markets has become a major concern for higher education institutions and employability scholarship. To explain how employability develops, several influential theoretical perspectives have been proposed, including Graduate Capital Theory, Social Cognitive Career Theory (SCCT), and the CareerEDGE Framework, which are widely recognized as representative frameworks. These perspectives have enriched the understanding of employability by emphasizing different mechanisms, including capital accumulation, career-related cognitive processes, and integrated competence development. Similarly, recent research in private Chinese universities showed that student outcomes and participation arose from a combination of factors rather than a single determinant (Mingyu et al., 2026; Yang et al., 2026).

According to Graduate Capital Theory (GCT), career readiness is built by acquiring diverse assets during higher education rather than focusing exclusively on scholarly attainment. Key dimensions include human capital (subject mastery and practical capabilities), social capital (industry connections and professional networks), and psychological capital (resilience, self-efficacy, and drive). This perspective suggests that universities

enhance students' employability not only through curriculum design but also by providing supportive learning environments and opportunities for meaningful industry engagement (Tomlinson, 2017).

More broadly, rewards and recognition may serve as an environmental resource that shapes positive responses. Evidence from the educational sector has found a relationship between both intrinsic and extrinsic rewards and professional commitment (Ligin et al., 2026). This reflects the general hypothesis that individuals' outcomes depend, to some extent, on their environment. SCCT complements this account by locating career development in the reciprocal interplay of contextual influences, individual characteristics, and career outcomes. From this perspective, supportive educational environments and institutional resources can enhance students' motivation and career-related behaviors, thereby improving employability (Lent & Brown, 2013). Within the current investigation, the learning environment and school–enterprise cooperation represent key environmental factors, while students' motivation reflects an important personal factor contributing to perceived employment competitiveness. Accordingly, SCCT offers a useful theoretical perspective for understanding how contextual support and individual motivation jointly influence employability development.

CareerEDGE views employability as a developmental process shaped by disciplinary knowledge, experience, transferable skills, and reflection. Real-life workplace experiences give learners the chance to build professional abilities and transferable skills that can be applied in different work environments, and through reflection, they can apply these experiences to their long-term professional and employability development (Dacre Pool & Sewell, 2007; Dacre Pool et al., 2014). In the current research, the partnership between the school and the enterprise offers a good means of workplace experience, supporting the development of transferable skills and reflection.

Although each perspective has advanced understanding of employability, their primary emphases differ, ranging from capital accumulation to career cognition and competence development. Limited attention has been devoted to explaining how institutional support mechanisms and students' motivation operate together to shape perceived employment competitiveness, particularly within Chinese universities with an application-oriented mission.

Drawing on HCT, SCT, ST, and SDT, this study contributes an integrative theoretical framework that explores the interaction between institutional context and individual psychological factors associated with students' employment competitiveness. At the macro level, HCT shows that educational investment enables the acquisition of employability-related knowledge, skills, and competencies. Consistent with this perspective, SCT suggests that these competencies are developed through authentic learning and socially situated educational environments. In addition, ST identifies school–enterprise cooperation as a catalyst for building complementary resources, making skills development more concrete and better aligned with the labor market. At the individual level, SDT further explains how intrinsic motivation and autonomy are associated with students taking active steps to turn school opportunities into employability advantages.

The proposed explanation therefore draws on several complementary theories rather than privileging one lens. This permits institutional conditions, situated experience, collaborative mechanisms, and psychological motivation to be considered together when interpreting perceived employment competitiveness in Chinese application-oriented higher education. Figure 1 presents the proposed framework.

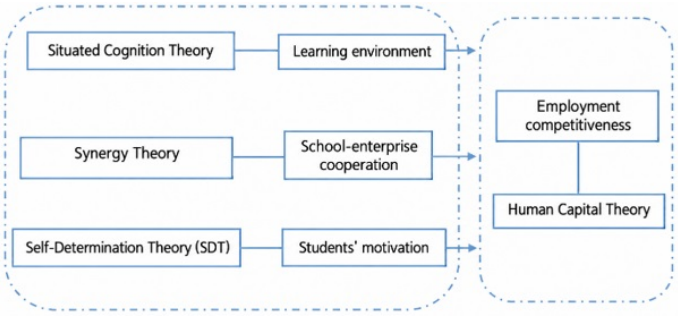


Fig. 1 *Integrating the study variables: Theoretical framework*

More precisely, the current study examines a Chinese application-focused institution and offers context-specific evidence on the relationship between employability, practice-based courses, and tight industry-university interaction. Unlike the limited number of prior studies that have considered predictors of employability in isolation, the present investigation considers these variables together through a multilevel lens including environmental, collaborative, and motivational aspects. It also reflects a broader trend in Chinese higher education toward application-oriented talent development and deeper industry–education integration.

Research Method

Study design

To assess the relationships between the learning environment, academic enterprise cooperation, student motivation, and undergraduates' perceived employment effectiveness, this study used a quantitative cross-sectional correlational methodology. The design allows estimation of both the direction and magnitude of bivariate associations and enables examination of the relative predictive contribution of the study variables. The data were gathered using structured online questionnaires and a Likert-scale instrument to quantify respondents' perceptions related to the constructs in question. The standardized scales will provide reliable responses. This paper uses both descriptive and inferential statistics.

Instrument of the study

The instruments used in the current research were adapted from previously validated instruments in the literature (L. Chen & Shin, 2025; Lei & Shin, 2026). Because most scales originated in English, the researchers conducted forward translation followed by back-translation to support cross-cultural appropriateness. Bilingual academic scholars initially translated the English items into Chinese, and independently back-translated them into English. The researchers addressed any discrepancies observed during the process to ensure the instruments were conceptually clear and contextually appropriate for Chinese undergraduates. A 23-item version of the WIHIC survey (What Is Happening in This Class?) was used to assess LE created by (Skordi & Fraser, 2018). A 19-item scale taken from Borah et al. (2021) was used to gauge school-enterprise cooperation. A 15-item version of the Student Psychological Needs Scale, developed by Goldman et al. (2016) and based on Gottfried (1985), measured student motivation. A 24-item scale, modified from Y.-C. Zhang et al. (2022), measured employment competitiveness. Each scale used a five-point Likert scale.

Study population

This empirical research examines tertiary learners at private higher education institutions with an application-oriented focus across Shandong Province, China. Universities in this region align closely with state mandates that foster practical undergraduate curricula and prioritize localized socio-economic progress through active academia-industry synergy. In particular, its educational model closely aligns with the core variables investigated in the current research, including LE, SEC, and SM.

Because surveying an entire target population is often impractical, quantitative studies commonly draw a sample intended to support defensible inference to the population of interest (Creswell & Creswell, 2017; Taherdoost, 2016). According to sampling and generalisability theory, appropriate sample selection is a methodologically sound choice that allows researchers to draw conclusions that reasonably represent the characteristics of the broader target population. To make the research practical and manage contextual variability, the study adopted a single-site sampling approach and was conducted at Qingdao Hengxing University. This method helped to maintain consistent institutional conditions for all participants and thereby improve the internal consistency of the study context.

In total, we obtained 1,281 survey responses. However, we excluded 54 survey responses completed in under 80 seconds because they were considered insufficiently reflective. We then dropped responses with missing data points, straight-lining patterns, or logical inconsistencies. After data-quality screening, we retained 956 valid responses for the final analysis. The final sample consisted of 326 students studying Science and Engineering, 318 studying Humanities and Social Sciences, and 312 studying Arts.

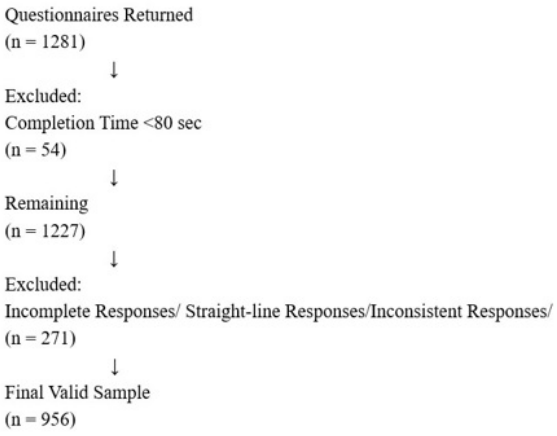


Fig. 2 *Sample selection and screening procedure*

The sample across the three academic disciplines was relatively even, with each group accounting for approximately 31% to 36% of the total respondents. This distribution ensured the representation of the three academic disciplines among the study sample. In addition, the final sample size of 956 respondents exceeded the minimum required for correlation and multiple regression analyses (Cohen, 1992; Hair et al., 2010; Iram et al., 2024). Figure 2 presents a participant inclusion and exclusion flowchart to provide a transparent overview of the sample selection and data screening process.

Additionally, the estimated sample size also meets widely recognized criteria for multivariate statistical analysis, providing sufficient statistical power (Cohen, 1992). The study was carried out at one university, a common application-oriented higher education location where collaboration between universities and industry and practice-based education are high. Hence, our findings can be interpreted with great contextual sensitivity for similar institutions and regions in China. Indeed, we must be careful when extrapolating the results to institutions and regions outside the Chinese context.

Pilot study

To ensure research transparency and reproducibility. All constructs were evaluated utilizing a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The pilot study assessed construct suitability and internal consistency through Exploratory Factor Analysis (EFA) and Cronbach's alpha.

The pilot study was conducted at Qingdao Hengxing University of Science and Technology (QU) from March 26 to April 8, 2025. A total of 156 undergraduate learners participated in the pilot study, and their responses were excluded from the final survey. The pilot study evaluated the clarity, relevance, and appropriateness of the questionnaire items and confirmed their suitability for the research context before administering the main survey. Cronbach's alpha coefficients were then calculated for each scale to assess internal consistency (Tavakol & Dennick, 2011). All scales showed good reliability. Alpha values of the learning environment scale were 0.865, University Industry Collaboration 0.839, student motivation 0.841, and employment competitiveness 0.863. All alpha coefficients exceeded the recommended threshold of 0.70 (Nunnally & Bernstein, 1994; Wahyuningtyas et al., 2026). Further exploratory factor analysis supported the instrument's construct structure. For all scales, KMO values exceeded 0.70, and Bartlett's test of sphericity yielded $p < 0.01$, suggesting the data were suitable for factor analysis. In summary, we found that the research instruments are psychometrically sound and therefore robust and valid for later empirical analysis. Figure 3 presents the timeline of the data collection process.

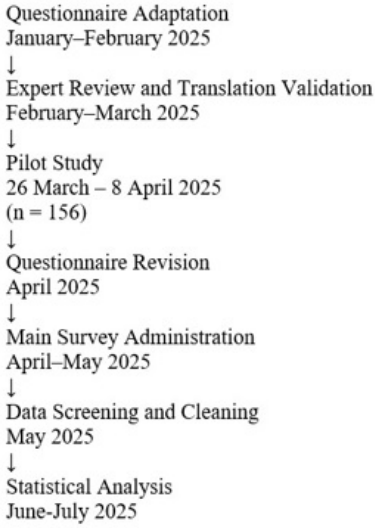


Fig. 3 *Timeline of the data collection process*

Ethical considerations

This study followed standard research ethics and was closely monitored during data collection. The researchers first informed participants of the research purpose. The study emphasized that participation was voluntary, ensuring confidentiality and anonymity, and that participants could withdraw at any time before questionnaires were administered without consequence. All participants provided written informed consent before participation. We also collected responses anonymously and did not collect any personal information. We ensured participant confidentiality

and used all collected data only for academic research. In addition, all research protocols received formal ethical review and approval from the competent institutional authority of Qingdao Hengxing University.

Common method bias assessment

Because we measured the constructs through self-reports collected in the same survey period, the analysis explicitly considered the possibility of Common-Method Bias (CMB). To reduce this concern, we integrated several precautionary measures into both the questionnaire design and the data collection phase. First, we assured respondents of confidentiality and anonymity to minimize evaluation apprehension and social desirability bias. Second, we drew items for different constructs from and adapted established measures and presented them in separate sections to reduce respondents' tendency to infer relationships among variables.

We used two complementary methods to determine whether common-method bias was present. First, we conducted Harman's single-factor test using exploratory factor analysis with unrotated principal component extraction. The results produced several factors with eigenvalues above 1, while the first factor accounted for 17.68% of the total variance, remaining below the recommended 40% threshold (Podsakoff et al., 2003; Salleh et al., 2023). Second, we assessed full collinearity Variance Inflation Factors (VIFs) following (Imdad Ali Shah, 2026; Kock, 2015). All VIF values were below the recommended cutoff of 3.3. These results indicate that common-method bias was not a significant concern in the present study.

Statistical analysis

The dataset was analyzed using SPSS Version 26 and SmartPLS 4. Descriptive statistics were initially used to summarize the respondents' demographic characteristics and the distribution of the study variables. Pearson correlation analysis then assessed the magnitude and direction of associations among LE, SEC, SM, and EC. This analysis was appropriate because the variables were measured on continuous scales and the study aimed to examine linear relationships among the constructs. Next, we used multiple linear regression to predict EC from LE, SEC, and SM. This analysis allowed us to determine each predictor's unique contribution while accounting for the effects of the other independent variables.

Multiple regression estimated the unique predictive contribution of the observed predictor scores. In contrast, PLS-SEM assessed the measurement model and the structural pathways among the latent constructs simultaneously. Thus, the two approaches were treated as complementary rather than as duplicate tests of the same analytical purpose.

SmartPLS 4 was additionally used to estimate a PLS-SEM model, providing a complementary assessment of the proposed framework. The measurement component evaluation covered indicator performance, Cronbach's alpha and composite reliability, AVE-based convergence, HTMT discriminant validity, and VIF diagnostics. The structural component was then examined through bootstrapping, focusing on path estimates, f^2 effect sizes, R^2 explanatory capacity, and Q^2 predictive relevance. PLS-SEM was chosen because it enables the simultaneous assessment of the measurement model and the structural relationships among latent constructs, providing a more comprehensive assessment of the proposed theoretical framework.

Findings

The final analytic sample comprised 956 undergraduates enrolled at Qingdao Hengxing University of Science and Technology and were either in their third or fourth year of study. Of these 956 individuals, 464 were men (48.53 percent), and 492 were women (51.46 percent). Regarding institutional affiliation, 326 individuals were from the College of Science and Engineering (34.10 percent), 318 from the College of Humanities and Social Sciences (33.26 percent), and 312 from the College of Arts (32.64 percent).

Normality test

We conducted a normality assessment for the full sample (n = 956) using the Kolmogorov–Smirnov test, the Shapiro–Wilk test, and skewness and kurtosis statistics. Table I shows that the Kolmogorov–Smirnov and Shapiro–Wilk tests were statistically significant for all study variables (p < .001), indicating deviations from strict normality.

Table I
Tests of normality

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
Learning environment	.079	956	<.001	.969	956	<.001
School-enterprise cooperation	.067	956	<.001	.973	956	<.001
Students' motivation	.091	956	<.001	.977	956	<.001
Employment competitiveness	.047	956	<.001	.988	956	<.001

Nevertheless, given the sample size, formal normality tests are very sensitive and may detect small deviations that are not practically problematic. Accordingly, we further examined skewness and kurtosis values. In Table II, all values were within the acceptable range of ±2.0, indicating that the data were approximately normally distributed.

Table II
Test of Skewness and Kurtosis

Variable	Skewness	Kurtosis
Learning environment	-.633	.204
School-enterprise cooperation	-.594	.183
Students' motivation	-.241	-.719
Employment competitiveness	-.398	.240

Testing for multicollinearity

The assumption was evaluated by calculating tolerance and Variance Inflation Factor (VIF) statistics for each predictor, with the results used to detect possible multicollinearity. According to Hair et al. (2010), multicollinearity is generally considered acceptable when tolerance values are greater than 0.10, and VIF values remain below 10. These commonly used criteria in social science research help determine whether the relationships between predictor variables are acceptable.

Table III shows the tolerance values for the three predictor variables in the regression model (0.848-0.906) and their corresponding VIF values (1.104-1.179). These values meet the most widely used criteria of tolerance greater than 0.10 and VIF less than 10, implying no multicollinearity among the variables in the model. The results show that this multicollinearity assumption is met. Thus, all predictor variables can be included concurrently in the subsequent analyses, enabling subsequent regression analysis using parametric statistical methods.

Table III
The tolerance and VIF value

Predictor Variable	Tolerance	VIF
Learning environment	0.848	1.179
School-enterprise cooperation	0.851	1.175
Students' motivation	0.906	1.104

Measurement model assessment

The measurement model was evaluated following the recommended PLS-SEM procedures, including reliability assessment, convergence validity, and discriminant validity evaluation.

Exploratory factor analysis

The KMO values ranged from 0.889 to 0.926, indicating excellent sampling adequacy and confirming that the data were appropriate for factor analysis. For each latent variable, the standardized factor loadings of the measurement indicators were acceptable, as shown in Table IV. Factor loadings ranged from 0.438 to 0.727 for the learning environment construct, 0.408 to 0.676 for the School Enterprise Cooperation construct, 0.415 to 0.559 for student motivation, and 0.412 to 0.649 for employment competitiveness. Although several items exhibited factor loadings around 0.40, they were retained in the model based on the statistical power considerations for large sample sizes (Hair et al., 2010). This means the observed variables adequately represent their latent constructs and capture each construct's underlying characteristics. As a result, the measurement model has satisfactory convergent validity and provides a suitable basis for subsequent structural model analysis.

Table IV
KMO test and Bartlett test

Construct	KMO test and Bartlett test	Factor Loadings
Learning environment	0.889	0.438–0.727
School-enterprise cooperation	0.926	0.408-0.676
Students' motivation	0.911	0.415-0.559
Employment competitiveness	0.923	0.412-0.649

Reliability and convergent validity

Table V presents the reliability and convergent validity results for all constructs. Based on the results, the reliability coefficients for the learning environment scale are 0.899, the School Enterprise Cooperation scale is 0.889, the student motivation scale is 0.845, and the employment competitiveness scale is 0.889. All values exceeded the widely recognized minimum threshold of 0.70, supporting the reliability of all measurement scales (Hair et al., 2010).

The reliability assessment yielded CR values between 0.885 and 0.917 for the constructs, surpassing the recommended criterion of 0.70 and thus supporting adequate internal consistency. In addition, AVE values ranged from 0.586 to 0.688, exceeding the 0.50 threshold and providing evidence of convergent validity (Hair et al., 2010). Taken together, the results support the measurement model's adequacy in reliability and convergent validity.

Table V
Reliability and convergent validity of the measurement model

Scale	N of Items	Cronbach's Alpha	CR	AVE
Learning environment	23	0.899	0.894	0.586
School-enterprise cooperation	19	0.889	0.885	0.661
Students' motivation	15	0.845	0.891	0.620
Employment competitiveness	24	0.889	0.917	0.688

Discriminant validity

Discriminant validity was assessed using the Fornell–Larcker criterion Fornell and Larcker (1981) and the Heterotrait–Monotrait (HTMT) ratio. As shown in Table VI, the square roots of the AVE values (the diagonal entries) exceeded the corresponding correlations between constructs. Specifically, the diagonal values ranged from 0.766 to 0.829 and exceeded the correlations among the constructs, indicating adequate discriminant validity for each construct.

Table VI
Fornell–Larcker criterion for discriminant validity

Construct	EC	LE	SEC	SM
EC	0.829			
LE	0.288	0.766		
SEC	0.731	0.364	0.813	
SM	0.243	0.237	0.239	0.788

In addition, the HTMT results in Table VII ranged from 0.275 to 0.833, all below the recommended threshold of 0.85 (Henseler et al., 2014). Therefore, the results provide evidence of adequate discriminant validity across the four constructs.

Table VII
Heterotrait–Monotrait Ratio (HTMT) criterion for discriminant validity

Variable	EC	LE	SEC	SM
EC				
LE	0.317			
SEC	0.833	0.431		
SM	0.275	0.277	0.292	

Descriptive analysis

This study initially performed descriptive statistical analysis to assess the overall attributes of the key study variables. Regarding learners' perceptions of the LE, the analysis produced a mean score of 3.598 and a standard deviation of 0.619. The mean score for school–enterprise cooperation was 3.697 (*SD* = 0.628), reflecting students' generally favorable perceptions of industry–education integration. Among the variables, student motivation had the highest mean (*M* = 3.801, *SD* = 0.540), indicating strong commitment and a target orientation toward learning. The average score for employment competitiveness was 3.731 (*SD* = 0.583), and students' self-evaluation of their employability was at an upper-middle level. Overall, all variables were above the midpoint; thus, participants perceived relatively positive evaluations of both the institutional support provided by higher education institutions and their own motivational factors. These results offer a first foundation for both correlation analyses and structural model studies. Table VIII presents the descriptive statistics of the study variables.

Table VIII
Statistical summary of survey constructs

Variable	Mean	SD	Interpretation
Learning environment	3.598	0.619	Moderately High
School-enterprise cooperation	3.697	0.628	Moderately High
Students' motivation	3.801	0.540	High
Employment competitiveness	3.731	0.583	High

Learning environment, school–enterprise cooperation, and student motivation in relation to employment competitiveness among students at Qingdao Hengxing university, China

Table IX presents the Pearson correlation analysis of 956 undergraduates and indicates positive relationships between the predictor factors and undergraduates' perceived employment prospects. In particular, SEC demonstrated a notable positive relationship with undergraduates' perceived employment prospects (r = .712, p < 0.01), suggesting that collaborative practices between universities and industry may be particularly beneficial for enhancing students' perceived employability. By comparison, both learning environment (r = .276, p < 0.01) and students' motivation (r = .278, p < 0.01) show weak but significant correlations. This difference underscores that although these factors are useful, their direct links to employability appear narrower at the bivariate level.

Table IX
Pearson correlation analysis

Construct		Learning Environment	School–Enterprise Cooperation	Students' Motivation
Employment competitiveness	Pearson Correlation Sig. (2-tailed)	.276**	.712**	.278**
	N			
	<.001	<.001	<.001	<.001
N	956	956	956	956
Pathway		Small–Medium	Large	Small–Medium

** p < .01 (two-tailed)

We concluded that although all three components are related to employment competitiveness, school–enterprise cooperation was the most important contextual factor. Accordingly, the findings provided support for hypotheses H1, H2, and H3. Nevertheless, multivariate analysis should further investigate these relationships to determine their relative predictive contributions while controlling for other factors.

Employment competitiveness among students at Qingdao Hengxing university, China: The role of learning environment, school–enterprise cooperation, and student motivation

To assess how well the three predictor variables estimate student EC, we evaluated a multiple linear regression model. As shown in Table X, SEC (B = .632, SE = .023, β = .681, t = 27.924, p < .001, 95% CI [.588, .677]) and *SM* (B = .114, SE = .026, β = .106, t = 4.476, p < .001, 95% *CI* [.064, .164]) were statistically significant positive predictors of students' EC. In contrast, LE (B = .011, SE = .023, β = .012, t = .478, p = .633, 95% *CI* [−.034, .056]) does not demonstrate a statistically significant predictive contribution. The full regression model was statistically significant (F = 340.543, p < .001) and accounted for 51.8% of the variability (R^2 = .518; Adjusted R^2 = .516).

Table X
Multiple linear regression estimations

Construct	*B*	Standardized β	*t*	*P* (Sig)	*SE*	95% *CI*
Learning Environment	0.011	0.012	0.478	.633	.023	[-0.034, 0.056]
School–Enterprise Cooperation	0.632	0.681	27.924	<.001	.023	[0.588, 0.677]
Students' Motivation	0.114	0.106	4.476	<.001	.026	[0.064, 0.164]
* Significant at the p<0.05 level (2-tailed)						

School–enterprise cooperation showed the strongest predictive contribution to perceived employment competitiveness. The confidence intervals and standardized beta coefficient indicate that stronger school–enterprise cooperation was associated with higher perceived employment competitiveness.

Structural model assessment

The structural model was assessed using VIF, f^2, R^2, and Q^2, with the results reported in Table XI. VIF values ranged from 1.000 to 1.187, indicating that multicollinearity was not a concern. Based on the effect size analysis, school–enterprise cooperation produced the largest effect on employment competitiveness (f^2 = 0.923), whereas the learning environment and student motivation demonstrated relatively smaller effects. The model accounted for 54.0% of the variance in employment competitiveness (R^2 = 0.540). Furthermore, all Q^2 values were greater than zero, demonstrating that the model had predictive relevance for the endogenous constructs.

Table XI
Structural model assessment results

Relationship / Construct	VIF	f^2	R^2	Q^2
LE → EC	1.186	0.000		
SEC → EC	1.187	0.923		
SM →EC	1.090	0.010		
LE →SEC	1.000	0.153		
LE → SM	1.000	0.059		
EC			0.540	0.079
SEC			0.133	0.129
SM			0.056	0.053

Table XII presents the direct and indirect pathways estimated using the PLS-SEM bootstrapping procedure. Regarding the direct pathways, the learning environment was not significantly associated with employment competitiveness (β = 0.013, t = 0.492, p = 0.623). The findings indicated that a significant positive association existed between the learning environment and school–enterprise cooperation (β = 0.364, t = 10.668, p < .001), as well as between the learning environment and student motivation (β = 0.237, t = 7.317, p < .001). In addition, school–enterprise cooperation was significantly and positively related to employment competitiveness (β = 0.710, t = 24.155, p < .001). Student motivation was also significantly and positively associated with employment competitiveness (β = 0.071, t = 3.242, p = .001)..

Table XII
Direct and indirect pathways of the structural model

Pathway	Path	β	t-value	p values	95% CI Lower	95% CI Upper
Direct	LE → EC	0.013	0.492	0.623		
	LE → SEC	0.364	10.668	< .001		
	LE → SM	0.237	7.317	< .001		
	SEC → EC	0.710	24.155	< .001		
	SM → EC	0.071	3.242	0.001		
Indirect	LE → SEC → EC	0.259	9.438	< .001	0.205	0.311
	LE → SM →EC	0.017	2.876	0.004	0.007	0.030

The indirect association between LE and undergraduates' perceived EC through university–industry collaboration was statistically significant (β = .259, t = 9.438, p < .001, 95% CI [.205, .311]). Hence, H5 was supported. Likewise, the indirect relationship through students' motivation was statistically significant (β = .017,t= 2.876, p = .004, 95% CI [.007, .030]). Consequently, H6 was supported. This indicates that the learning environment was indirectly associated with undergraduates' perceived employment competitiveness through university–industry collaboration and students' motivational engagement.

Discussion and Conclusion

Learning environment as a factor in employment competitiveness

Although the educational setting correlates positively with career competitiveness, data indicate its direct pathway was not statistically significant. This implies that academic surroundings operate primarily as an underlying facilitating structure rather than an immediate determinant of job market readiness. Aligning with prior empirical observations, such as those reported by Widiyanti et al. (2020), the present data reflect that the influence of the learning environment on employability was largely indirect through learning motivation and academic performance, while Chigbu and Nekhwevha (2022) also found limited evidence of a direct relationship between learning context and employability outcomes. Together, studies and the present findings suggest that the LE enhances students' workplace preparedness by fostering student engagement, motivation, and meaningful learning experiences rather than through a direct pathway to employment competitiveness.

Our findings contrast recent studies showing a direct effect of the learning environment on employability (Choi-Lundberg et al., 2024; H. Zhang et al., 2023) by showing that the learning environment is a supportive context in application-oriented institutions. In such specialized settings, direct work-integrated opportunities (SEC) and internal drive (SM) have a much more immediate impact on employment competitiveness than do general institutional conditions.

These results reinforce the theoretical framework that integrates the study variables proposed in the current research by demonstrating that the learning environment contributes to employment competitiveness primarily through indirect pathways. The mediation analysis indicates that contextual support provided by universities enhances employability when it is translated into stronger school–enterprise cooperation and higher levels of students' motivation. This interpretation accords with Situated Cognition Theory, which emphasizes that learning occurs through participation in authentic social and professional contexts rather than solely through classroom instruction. It also aligns with the CareerEDGE framework and Graduate Capital Theory, both of which view employability as resulting from the interplay of institutional support, experiential learning, and individual psychological resources. Accordingly, the non-significant direct pathway of the learning environment suggests that institutional learning conditions alone may be insufficient to enhance employment competitiveness unless they are transformed into authentic industry engagement and meaningful learning experiences that foster students' employability.

The mediation analysis further demonstrates that both SEC and students' motivation serve as significant mechanisms linking the learning environment with employment competitiveness. This finding explains why the direct pathway of the learning environment became statistically insignificant once these mediating variables were incorporated into the structural model.

Overall, these results add to the employability literature by providing empirical support that the educational setting acts as a supportive context, with its effects realized through institution–industry partnerships and learners' motivational engagement rather than directly predicting graduates' EC.

Employment competitiveness in relation to school–enterprise cooperation

The findings from the present investigation demonstrate that institution–industry collaboration has the strongest positive relationship with undergraduates' labor-market competitiveness among all the predictors examined. This pattern suggests that stronger partnerships between higher education institutions and industry are closely linked to students' perceived readiness for employment.

Collaborative initiatives between universities and industry reduce the gap between theoretical curricula and workplace expectations (X. Chen & Li, 2025; Y. Zhang & Chen, 2023). Through practical placements, work-integrated modules, and industry-led projects, undergraduates can translate conceptual principles into hands-on practice. More importantly, ongoing exposure to authentic workplace settings helps students develop transferable competencies, including problem-solving, teamwork, adaptability, and professional communication, all of which are critical to employment competitiveness.

Beyond skill and knowledge acquisition, school–enterprise cooperation is also critical for shaping students' professional identity and understanding of workplace culture. Rather than conventional classroom learning, industry collaboration gives students opportunities to develop tacit knowledge and realistic insights into job-role expectations that are typically hard to acquire through formal academic instruction alone (Sá & Serpa, 2018). This may explain why school–enterprise cooperation was identified as the strongest predictor within the current investigation. This result is also consistent with international research emphasizing the role of work-integrated learning in graduates' employability. Studies conducted in Europe and Australia have similarly shown that internships, industry projects, and workplace-based learning experiences significantly enhance students' readiness for future careers and transition to employment. The convergence of findings across different educational contexts suggests that authentic engagement with industry represents a universal mechanism for developing employability-related competencies.

Its standardized coefficient is much greater than that of other variables, suggesting it may act not merely as one of several contributing factors but as a dominant mechanism in shaping employability outcomes. It also suggests that employability development in application-oriented higher education is driven more by proximal, practice-based experiences than by more distal contextual or psychological factors. In that sense, school–enterprise cooperation may serve as a direct pathway through which students acquire job-relevant competencies, thereby reducing the relative influence of variables such as the learning environment.

From the perspective of Synergy Theory, the strong effect of school–enterprise cooperation supports the proposition that collaborative interactions between educational institutions and industry generate outcomes that exceed what either party can achieve independently. By integrating academic resources, workplace experiences, and industry expertise, students gain richer learning opportunities and more direct access to employability-related competencies. The present findings accordingly offer empirical support for the value of synergistic partnerships in enhancing employment competitiveness.

Employment competitiveness in relation to students' motivation

Statistical analysis confirmed a meaningful positive relationship linking student drive to perceived occupational readiness. This shows that undergraduates with higher internal drive and a target-oriented focus see themselves as better equipped to navigate competitive recruitment

landscapes. This aligns with prior research emphasizing the role of motivation in the employability process (Li et al., 2022; Lisá et al., 2023; Parker et al., 2010). Undergraduates with stronger motivational engagement are also more likely to participate in employment-related activities, including skills enhancement, internships, goal formulation, and career development planning. Such behaviors are closely associated with the development of employability competencies, including persistence, initiative, adaptability, and confidence when navigating job-seeking situations.

This finding aligns with international evidence indicating that motivated students are more likely to engage in proactive career behaviors and skill-development activities that enhance employability. Similar relationships have been reported across diverse educational contexts, suggesting that student motivation is a relatively universal psychological resource for career development and employment preparation.

Yet, in our analysis, it is also important to consider student motivation alongside other predictors. While motivation is a statistically significant positive predictor, its predictive contribution is notably weaker than school–enterprise cooperation. Motivation is considered a key factor from a psychological perspective, but it may prove insufficient without appropriate practical learning opportunities.

From a theoretical standpoint, this finding aligns with self-determination theory, which argues that motivation improves engagement and development but also depends on supportive contexts. More specifically, Self-Determination Theory argues that students' needs for autonomy, competence, and relatedness must be satisfied for them to stay engaged and work towards their career goals. This finding is consistent with the theoretical expectations of Self-Determination Theory.

Integrated theoretical and practical implications

Integrated theoretical contribution

Overall, empirical findings demonstrate that organizational structures, practical exposure, and psychological motivation are collectively linked to graduates' preparedness for the labor market, although their predictive influences vary in strength. More specifically, university–industry partnerships emerged as the principal predictive factor, followed by individual learners' motivational engagement. In contrast, the educational setting's direct influence on labor-market competitiveness was not statistically significant. Another noteworthy aspect of the study is its recognition of the learning environment's indirect role. Although its direct pathway towards labor-market competitiveness was not significant, the mediation analysis revealed significant indirect relationships operating through university–industry collaboration and students' motivational engagement. This finding suggests that supportive educational contexts can strengthen employability by fostering institutional partnerships and activating learners' motivational resources, rather than directly enhancing their competitiveness within the labor market.

An important finding concerns the learning environment. Although its direct relationship with labor-market competitiveness was not statistically significant, the educational setting demonstrated indirect links with graduates' labor-market prospects through university–industry collaboration and learners' motivational engagement. The findings indicate that favorable educational contexts can foster employability by promoting institutional partnerships and strengthening learners' motivational capacities, rather than by directly enhancing their prospects of securing employment.

Conceptually, the study brings SCT, ST, and SDT into a single explanatory account of employment competitiveness in applied higher education. The study also contributes to the literature by operationalizing employment competitiveness as a multidimensional construct rather than simply as indicators of employment rate, as in previous cases, and by linking it to broader behavioral, cognitive, and professional competencies considered important in the labor market.

Rather than treating employability predictors separately or reducing outcomes to employment rates, the analysis treats employment competitiveness as a multidimensional construct embedded in an integrated explanatory model. As a consequence, it provides a more comprehensive theoretical explanation of employability development in universities with an application-oriented mission.

Connections with established employability theories

This finding accords with Graduate Capital Theory, which proposes that employability develops through the accumulation of multiple forms of capital. School–enterprise strengthens social and human capital, while students' motivation contributes to psychological capital. The findings also support the assumptions of Social Cognitive Career Theory (SCCT), which emphasizes that career outcomes emerge through interactions between environmental supports and personal factors. Within the current investigation, school–enterprise cooperation and learning environment represent contextual supports, whereas motivation functions as an important individual resource contributing to perceived employment competitiveness. In addition, the dominant role of school–enterprise cooperation reinforces the CareerEDGE Framework, highlighting the importance of authentic workplace experiences in developing employability-related competencies.

Practical implications

For universities, the results support embedding employability across curriculum design, authentic practice-based learning, and assessment that reflects industry expectations. In addition, university administrators should strengthen both physical and digital learning environments while

establishing long-term mechanisms to evaluate graduates' employability and continuously improve educational quality. Academic institutions should therefore assess how actively students engage with digital learning tools and educational activities. Current studies in higher education show that behavioral engagement and the alignment of learning activities with assessment practices remain significant, even in learning technologies-mediated settings (Wang et al., 2026; Yadan et al., 2026). Technology-enhanced learning environments may also allow learning to occur outside the traditional classroom by letting learners access various digital learning resources and platforms (Shin, Mosin, et al., 2025; Shin, Ni, et al., 2025).

Enterprise partners can contribute beyond short placements by taking substantive roles in curriculum development, authentic projects, and professional mentoring. Such sustained collaboration enables students to develop practice-oriented skills, gain workplace experience, and better align their competencies with labor market expectations. Policymakers can further encourage these partnerships by supporting sustainable collaboration between universities and industry models.

Students should take an active role in enhancing their own employability by developing intrinsic motivation, engaging in experiential learning opportunities, and participating in career planning and extracurricular activities. Strengthening self-directed learning, professional competence, and career awareness can help graduates adapt more effectively to changing labor market demands and improve their long-term employment competitiveness.

Conclusion

This research contributes significantly to existing scholarly discourse by simultaneously evaluating the educational setting, industry partnerships, and individual student drive within a unified empirical framework. Findings confirm that graduate job readiness cannot be reduced to a single variable, but is instead the collective result of institutional backing, practical exposure, and personal internal drive. The findings further indicate that institution–industry collaboration is the strongest predictor of labor-market competitiveness. At the same time, learners' motivational engagement also contributes positively, albeit to a lesser degree. More importantly, the academic setting was not directly related to employment competitiveness. Instead, its influence was reflected through significant indirect relationships with employability, primarily via institution–industry collaboration and learners' motivational engagement. Viewed collectively, these results imply that improving employability requires not only supportive learning environments but also effective collaboration between universities and industry and sustained student motivation.

These are some of the weaknesses of this study despite its contributions. First, the cross-sectional nature of this research means that it is not possible to establish the causality between variables. In addition, the study measured employment competitiveness using students' self-reported perceptions rather than objective employment indicators, such as employment status, salary level, number of job offers, or employer evaluations. Accordingly, the findings should be interpreted as reflecting perceived employment competitiveness rather than actual labor market performance. Future investigations could adopt longitudinal designs and combine subjective perceptions with objective employment outcomes collected after graduation to provide a broader understanding of graduates' employability.

Secondly, the study sample consists of students from a single private applied university in China, which may limit the generalisability of the findings. Future research could encompass several universities across different regions and educational systems to strengthen external validity and broaden the applicability of the results. Furthermore, drawing on data from multiple sources and investigating potential mediating or moderating factors, such as self-efficacy, career adaptability, and internship experience, could offer a more comprehensive understanding of the mechanisms that shape graduates' labor-market competitiveness.

Overall, the study supports a multidimensional view of employability development in which institutional collaboration, learning experience, and individual motivation are interconnected. It also provides a useful foundation for future research and for designing employability-oriented reforms in universities with an application-oriented mission.

Conflict of Interest

The authors confirm that no competing interests are associated with this article.

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Author contributions

Conceptualization, C.L.; methodology, C.L.; formal analysis, C.L.; investigation, C.L.; data curation, C.L.; writing—original draft preparation, C.L. and C.S.; writing—review and editing, C.S.; supervision, C.S. and J.I. All authors have examined and endorsed the final version of the manuscript for publication.

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The data underlying this study's findings are available from the corresponding author upon reasonable request.

Use of artificial intelligence

The authors used ChatGPT to support language refinement and grammatical revision during manuscript preparation. The authors undertook and verified all intellectual contributions, data analysis, interpretation of the findings, and final amendments to the manuscript, and remain fully accountable for the content of this publication.

Ethics statement

This research was carried out in compliance with the ethical requirements established by the institutional research committee. Participation was optional, and all respondents provided informed consent before data collection began.

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