

Aligning Higher Education Programs with Labor Market Demands: An Analysis of Information Technology Skills Gaps Among University Graduates in Liaoning Province

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Abstract—The rapid expansion of Liaoning Province's IT sector has revealed substantial skill gaps among university graduates, emphasizing a misalignment between higher education curricula and industry requirements. Employers frequently report deficiencies in key technical competencies such as programming, artificial intelligence, cloud computing, and cybersecurity. Additionally, inadequate soft skills—including problem-solving, teamwork, adaptability, and communication—further hinder employability. These deficiencies negatively impact job placement rates, workforce competitiveness, and regional economic and technological advancement. Addressing these gaps is crucial for equipping graduates with industry-relevant skills and supporting the sustainable development of the IT sector. This study investigates the IT skills gap, evaluates the alignment between university curricula and employer expectations, and proposes targeted curriculum enhancements to improve graduate job readiness. A mixed-methods approach will be employed, integrating employer surveys, curriculum analysis, and faculty interviews. Quantitative data will identify specific skill deficiencies, while qualitative insights will explore institutional barriers, industry perspectives, and challenges in curriculum reform. Correlation and regression models will analyze the relationship between curriculum design and graduate employability outcomes, providing a comprehensive assessment of the issue. Findings will inform evidence-based recommendations, including integrating emerging technologies, enhancing experiential learning, updating teaching methodologies, and fostering stronger university-industry collaboration. By addressing these challenges, this research aims to improve graduate employability, support technological innovation, and contribute to Liaoning's long-term economic and industrial growth.

Keywords—Higher education, Labor market demands, IT skills gaps, University graduates.

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I. INTRODUCTION

Background

Aligning higher education curricula with the evolving needs of the labor market is critical for developing an effective workforce and supporting economic growth (Tomlinson, 2012). This is especially true in rapidly developing economies like China, where industries are undergoing technological transformations. Liaoning Province, a major economic hub in northeast China, has seen its information technology (IT) sector experience substantial growth in recent years (Zhang & Zhang, 2018). However, this expansion has revealed potential skills deficiencies among university graduates entering the IT workforce.

Universities play a vital role in equipping students with the technical and soft skills demanded by employers (Jackson, 2015). A curricula well-matched with industry needs can produce graduates ready to transition into professional roles. Conversely, a misalignment can lead to skills gaps that hinder graduate employability and companies' talent pipelines (Itō, 2019). Addressing such gaps is important for China's sustainable development goals.

Problem Statement

Despite Liaoning's flourishing IT industry, many companies report difficulties in recruiting qualified university graduates with up-to-date technical skills. This perceived skills gap between higher education outputs and industry demands poses challenges for both graduates seeking employment and companies aiming to fill talent needs. The failure to solve this disconnection can be a bottleneck of the progress, productivity, and the economic growth of the IT industry (Cunningham & Villaseñor, 2016). To identify the exact skills shortages, a detailed examination of the curricular misalignments, and the deficiencies in skills acquisition is necessary.

Research Aim

The central aim of this study is to critically look at the IT skills gap that characterizes the university graduates in the Liaoning region and the employer's specific requirements for these skill sets in the IT industry. The research intends to pick out the curricular misalignments that are possibly resulting in these skill deficiencies.

Research objectives

To determine the relationship between university IT curriculum content and perceived technical skills proficiency levels among graduates.

To examine the degree of alignment between the skills emphasized in current Liaoning university IT programs and the specific skill needs identified by IT industry employers.

To assess how modifications to IT curriculum structure and course offerings could potentially improve job-readiness of graduates.

II. PRELIMINARY LITREATURE REVIEW

Literature Review

The skill mismatch between education in higher education and industry needs has been reviewed at different levels. One of the core theoretical structures is the human capital theory which regards education as an investment in

developing skills and knowledge to increase the rate in productivity of workers (Olaniyan & Okemakinde, 2008). There are cases when skills in demand deviate from skills out there, which leads to unemployment, and poor economic efficiency levels (Van den Broeck, 2008).

In China, where the labor market is on a continuous changing path, the issue of occupation mismatches between the curricula of universities and the labor market has been brought up (Li et al., 2017). A number of articles have focused on skill gaps within the IT domain. A study conducted by Bai (2021) showed that more than 60% of IT firms consider graduates with a weak practical programming knowledge to be deficient in this area. Zhang et al. (2020) highlighted gaps in areas like cloud computing, AI, and cybersecurity based on interviews with both educators and employers.

Specific to Liaoning Province, the government's 14th Five-Year Plan stresses skills development as key for the region's IT industry growth (LPDE, 2022). However, there is limited published research directly examining IT skills gaps among Liaoning university graduates from an industry perspective. Most related studies (e.g. Wang et al., 2021; Qu, 2020) have relied primarily on self-reported data from students/alumni rather than employer assessments.

Numerous studies have identified gaps between the skills obtained through university computing and IT programs in China and the evolving needs of industry employers. A mixed methods study by Jia et al. (2022) specifically examined this curriculum-industry divide across Chinese universities. Surveying 325 faculty members and 227 IT professionals, coupled with qualitative interviews, their research uncovered significant gaps in areas like cloud computing, AI, and data analytics. Only 38% of educators felt their curricula was well-aligned with industry skill demands. Through qualitative insights it was found out that the bureaucracy practices like rigid processes and approval routes are some of the barriers which obstruct responsive curriculum reform. Suggestions such as expanding the university-industry connections, providing more experiential learning opportunities, and developing the curriculum with specialized jam tracks to cover emerging skills areas were offered.

In order to find out the employers' perspective Bai (2021) surveyed 126 IT companies among which were located in Hubei Province about the skills importance and the competencies observed among recent graduates. An overwhelming 60% of employers said job seekers were not prepared at all in term of programming skills. Weak spots in the area of data mining, cybersecurity, and cloud design were also pointed out. It was established that this deficit even in basic professional skills like problem-solving and communication was being seen. In order to provide a solution to the problem, recommendations that cover practical coding exercises at an early stage of the curriculum, and AI explicit training from the first year of the course and internship and capstone experience should be given a top priority.

The paper by Zhang et al. (2020) involves a mixed methods research design where 258 companies and 36 universities from China were covered in the survey. The main suggestion was to integrate AI/data skill development throughout all the computing degree programs, not only in

the form of separate disciplinary courses. They also urged updating faculty tenure/promotion criteria to value currency in industry-relevant skills.

Collectively, these studies from various regions of China point to persistent curriculum misalignment issues spanning technical skills like programming, emerging domains like AI/data science, and vital soft skills like problem-solving. Experiential learning, university-industry collaboration, and holistic integration of evolving skill areas across curricula consistently emerged as recommended strategies to bridge gaps. The proposed study can build on these findings within the context of Liaoning's provincial economy and IT sector.

Barriers and Issues

An oft-cited factor is the pace at which technologies change, causing university curricula to becoming outdated rapidly (Maqin & Sugiharto, 2020). However, Dong & Yuan (2019) found curriculum reform efforts hampered by institutional barriers like rigid processes. The most important issue of concern was that the employer's representatives believed that universities were behind in terms of the AI and big data engineering skills their businesses required. The interview data showed some deficiencies and gaps in the fields of machine learning, natural language processing, and other sub-fields of AI.

Approach

Jia et al. (2022) conducted a case study suggesting integrating more industry collaboration and internships into IT programs could reduce skills gaps.

III. METHODOLOGY

Research Questions

- 1 What are the critical IT skills gaps perceived by employers between the skills of recent university graduates and the skills required for workforce entry-level roles in Liaoning's IT industry?
- 2 To what extent do the curricula and skill emphasis areas of major IT programs at Liaoning universities align with the specific workforce needs identified by IT companies?
- 3 What curricular modifications (e.g., new courses, experiential learning, updated content) could potentially improve the job-readiness of IT graduates based on the assessed skills gaps?

Research Design

This study will employ a mixed methods research design, utilizing both quantitative and qualitative data to provide a comprehensive analysis of the research problem (Creswell & Creswell, 2018). Specifically, an explanatory sequential design will be followed.

The quantitative phase will involve a cross-sectional survey of IT industry employers in Liaoning Province. This non-experimental design is appropriate for examining skill gaps and curricula alignment perceptions across companies at a single point in time (Bhat, 2019). The surveys will

collect numerical data on skill importance ratings, graduate proficiencies, and curricula feedback.

The qualitative phase will consist of document analysis of university IT program curricula and follow-up interviews with select faculty members. This will provide deeper insights into the specific curricular content, pedagogical approaches, and perspectives on employer needs (Bowen, 2009).

The sequential nature allows the initial quantitative results to guide purposive sampling for the qualitative component (Creswell & Plano Clark, 2011). For example, curricula from universities rated poorly on alignment can be prioritized for analysis.

Finally, the quantitative and qualitative data will be integrated through triangulation, merging the statistical outputs with coded curricula mappings and interview themes. This mixed methods approach combines the strengths of both datasets to develop holistic and well-substantiated curriculum recommendations (Terrell, 2012).

Prioritizing quantitative data first, while using qualitative data for supplemental explanation, follows recommended practice for studies addressing real-world, applied problems (Morse, 2003).

Participants

The study will employ a cross-sectional survey research design to collect quantitative data. The target participants will be IT industry professionals currently employed at companies operating in Liaoning Province. To ensure relevant perspectives, the sample will focus on individuals involved in recruitment, hiring, training, and/or management of recent university graduate hires.

Sample size calculation indicates a minimum of 200 respondents is required for adequate statistical power, assuming a 95% confidence level and 5% margin of error (Fazli & Sam, 2020). Convenience sampling will be used to recruit participants via professional networks, industry associations, and recruitment platforms specific to Liaoning's IT sector.

In addition to respondent criteria like supervising new graduate hires, the company demographics aimed for are a mix of large established firms and smaller/newer companies as well as representation across key IT domains like software, hardware, services, etc. This diversity will allow for assessing consistencies or variations in perceived skills gaps (Cohen et al., 2017).

The quantitative survey data will be supplemented by qualitative curriculum analysis from university program documents and interviews with select faculty for triangulation purposes.

Hypotheses

H1: There is a significant positive correlation between the alignment of university curricula and employer-assessed job-readiness of IT graduates.

H2: Updates to curricula based on skills gaps analysis will improve predicted job-readiness scores in a regression model.

Instruments

The primary data collection instrument will be a structured questionnaire developed specifically for this study. The questionnaire design will be guided by best practices from prior skills gap and workforce preparedness research (Azmi et al., 2018).

The questionnaire will consist of three main sections:

- 1 1.Company and Respondent Profile: This will gather data on company characteristics (size, industry subsector, age) and the respondent's role related to hiring/managing recent IT graduates.
- 2 2.Skills Assessment: Using structured rating scales, respondents will evaluate the importance of various technical, analytical, and soft skill areas for entry-level IT roles. They will then rate the proficiency levels typically observed among recent university graduate hires across those same skills (Mitchell et al., 2010).
- 3 3.Curriculum Feedback: Respondents will provide their perceptions on the alignment of skills emphasized in typical university IT curricula based on job requirements. Open-ended feedback on recommended curricular changes will also be solicited.

The instrument will be piloted with a small sample to ensure clarity, content validity, and estimate completion time (Portney & Watkins, 2009). Both English and Chinese versions will be prepared. Online and paper-based modes will be utilized for higher response rates.

Psychometric properties like internal consistency reliability of scaled items will be assessed post data collection (Taber, 2018). Construct validity of skill gap measures will be evaluated through exploratory factor analysis.

Data Analysis

The analysis will utilize quantitative techniques to examine relationships between variables and test hypotheses related to skills gaps and curricula alignment perceptions. All analyses will be conducted using SPSS statistical software.

After data cleaning to handle missing values and any outliers (Osborne, 2013), descriptive statistics will first be calculated. This includes frequency distributions, measures of central tendency (means), and variability (standard deviations) for key variables. Calculating mean importance and proficiency ratings allows for gap analysis to identify skills with the largest discrepancies, signaling areas of deficiency (Lester, 2014).

To test the hypothesis that stronger curricula-industry alignment relates to higher perceived job-readiness of graduates (H1), Pearson's correlation analysis will examine the relationship between the two variables (Schober et al., 2018). Correlation coefficients, significance levels, and confidence intervals will be reported.

Multiple linear regression will be used to assess how well overall skills gaps, specific skill deficiencies, and curricula alignment ratings predict employer assessments of graduate job-readiness (H2). This allows modelling which factors carry the greatest weight and explanatory power for the outcome variable (Cohen et al., 2003). Standardized

coefficients from the regression will rank-order the relative influence of predictors on job-readiness scores.

These analyses directly address the core research questions by quantifying skills gaps, measuring curricula alignment perceptions, and modeling how those factors impact job-preparedness assessments. The results can then inform targeted curricula adjustments.

IV. CONCLUSION

In conclusion, this quantitative study will employ a cross-sectional survey design to collect data from IT industry professionals in Liaoning Province. Descriptive statistics and gap analysis techniques will identify specific skills deficiencies among recent university graduates. Correlation analysis will assess the hypothesized relationship between curricula alignment perceptions and employer ratings of job-readiness. Finally, multiple regression modeling will determine which skills gaps and alignment factors best predict graduate job-preparedness ratings. The findings from these analyses will provide an evidence-based assessment of where IT curricula revisions are most critically needed to better equip students with the skills required by employers. This data-driven approach aims to directly inform curriculum enhancement efforts.

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