Enhancement of Competencies in Software Technology Specialisation at Vocational Institutions: A Case Analysis of Luoyang Vocational College of Science and Technology

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Abstract

The competitive edge of the software industry critically depended on the expertise of its software technology specialists. Given this context, the current investigation centered on Luoyang Science and Technology Vocational College, which was distinguished by its provincial recognition in software technology specialisation. This study employed a qualitative methodology, notably through semi-structured interviews, involving alumni from the software technology program and experts from information technology firms both within and beyond the province. The results identified several pressing concerns, such as the misalignment between the educational curriculum and the practical demands of the industry, the inadequate focus on the development of essential skills and practical knowledge, and the deficiency of vocational literacy within software technology education. To tackle these issues, the research advocated for specific, customised strategies designed to close the gap between educational offerings and market needs, improve the development of practical abilities and experiential learning, and strengthen vocational literacy within software technology curricula. The implementation of these strategies was suggested not only for Luoyang Science and Technology Vocational College but also for similar institutions aiming to effectively prepare software technology professionals capable of excelling in the highly competitive software sector.

Keywords: *Software Technology Specialization, Talent Development, Vocational Colleges*

INTRODUCTION

In recent years, the global software industry has experienced an extraordinary expansion, advancing at a rate previously unseen. A detailed survey by IDC in 2012 highlighted that domestic demand for software professionals surged by approximately 1.3 million individuals, with an anticipated annual growth rate of 25.8%. This dramatic growth has simultaneously underscored a critical deficit of highly skilled practitioners fundamental to the software industry (Software Industry Risk Analysis Report, 2012). Looking back to the scenario a decade earlier, in 2002, the software workforce in China numbered 590,000, characterized by an olive-shaped structure. This structure comprised a significant cluster of 340,000 professionals, alongside 40,000 senior experts, 200,000 intermediate talents, and 100,000 entry-level workers (Yuan & Wong, 2021).

Despite the challenges posed by this burgeoning demand and structural composition, the software industry in our country continued to exhibit a rapid development trajectory. As evidenced by the remarkable statistics of 2010, the revenue from software businesses soared to an impressive 1336.4 billion yuan, recording a remarkable year-on-year growth rate of 31%. Notably, the industry's robust growth also led to an expansion in the workforce, surpassing the 2 million marks. Consequently, the pervasive influence and transformative power of software technology in various facets of social life and production displayed a continuous upward trend (National Software Business, 2010). These findings underline the pressing need to address the shortage of highly skilled personnel to sustain and enhance the remarkable progress of the global software industry. As the industry continues to evolve rapidly, concerted efforts must be made to nurture and equip the next generation of software talents, ensuring they are well-prepared to meet the evolving challenges and opportunities in this ever-evolving landscape.

Regarding the employment landscape within the IT industry, there has been a significant surge in demand for Java software engineers within Chinese software enterprises. A notable study conducted in 2013 revealed that the number of job openings for Java software engineers skyrocketed from a minimum of 80,000 in 2009 to an

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impressive 200,000 positions by 2012 (Asean Investment Report, 2020–2021). The escalating demand for Java software talents led to a pronounced talent shortage, prompting a considerable rise in the salary levels for these skilled professionals. Based on salary statistics collected from nearly 1,000 enterprise members by Eastern Standard, it was found that Java software engineers with just one year of work experience commanded an annual salary ranging from approximately 100,000 to 130,000 yuan. Notably, fresh graduates who had undergone relevant training in Java software development were able to secure a monthly salary of at least about 4,000 yuan, significantly surpassing the average monthly salary of fresh graduates, which stood at around 2,500 yuan in 2012.

As the demand for Java software engineers continues to rise, understanding the current status of talent training both domestically and internationally has become a crucial area of research. Various institutions and industries are seeking to explore and analyze the approaches taken by different regions in nurturing and equipping software talents, particularly in Java-related expertise. By delving into the latest research findings and initiatives from both local and global perspectives, a comprehensive understanding of the talent training landscape can be obtained, aiding in the formulation of effective strategies to address the ever-increasing demand for skilled Java software engineers. Through this knowledge, stakeholders can better align their efforts to develop and implement comprehensive training programs that meet the evolving needs of the IT industry and bridge the talent gap efficiently.

In her comprehensive research, (Zhang, 2004) undertook an in-depth investigation into the state of software talents in the vibrant city of Dalian. Utilizing the focus group interview method, she skilfully analysed the talent landscape and brought to light three critical issues plaguing the region's talent training endeavours. These challenges included a shortage of technical talents, a dearth of competent management talents, and a lack of clear training objectives within enterprises. In the quest to unravel the dynamics of the software industry, (Zhang, 2004) astutely recognized that the true essence of competition lies in the calibre of talents nurtured. With this profound understanding, her research zeroed in on Dalian's software technical talents, a subject of paramount importance in addressing the identified problems. The significance of this study extends beyond its academic pursuit, as its findings hold the potential to instigate meaningful change. By shining a spotlight on the challenges faced by Dalian's software talent ecosystem, stakeholders can proactively devise targeted strategies to address the talent shortage and foster an environment conducive to producing highly skilled professionals.

Ultimately, this research serves as a valuable resource, guiding the development of talent-centric initiatives that can pave the way for Dalian's software industry to flourish in the intensely competitive landscape.

In her groundbreaking study, (Yuan, 2020) embarked on a multifaceted journey to unravel the intricate facets of software technology talent competency. Commencing with a meticulous literature review, she adeptly curated a comprehensive list of quality items pertinent to this domain. Building upon this foundation, (Yuan, 2020) further honed her investigation through the innovative behavioural event interview method, distilling the essence of software technology talent competency characteristics. The culmination of her rigorous analysis resulted in the identification of 15 pivotal elements, each contributing significantly to software technology talent competency. These key findings, backed by the frequency and ranking of the quality items, presented a vital reference point for guiding the quality training of software technology talent. While the study undeniably shed light on crucial aspects of software technology talent competency, it did reveal a noteworthy gap in research concerning technical skills training. Addressing this omission holds paramount importance in shaping a holistic approach to talent development.

By delving into the realm of technical skills training, Yuan (2020)'s work can be enriched, equipping stakeholders with a more comprehensive toolkit to cultivate software technology talents who not only possess essential competencies but also excel in their technical prowess. This synergy of qualities will undoubtedly foster a new generation of software professionals primed to thrive in the ever-evolving landscape of the technology industry.

In his visionary work, Gong (2020) presents a groundbreaking proposal aimed at bridging the gap between job requirements and talent cultivation. With a keen focus on the field of software technology talents in higher vocational institutions, Gong (2020) advocates for the development of a robust job competency model that

aligns seamlessly with the diverse demands of different job roles. This multifaceted model encompasses three critical levels: general competency, job-specific competency, and vocational core competency. By crafting this comprehensive framework, Gong (2020) sets the stage for a more targeted and effective talent cultivation process. Emphasizing the importance of practicality, the proposed curriculum system is meticulously tailored to address the unique job task requirements of each position within the software technology domain. Such a tailor-made approach holds tremendous promise in addressing the insufficiencies that may have been evident in the current state of talent cultivation. Gong (2020)'s pioneering research undoubtedly wields significant guiding influence in the realm of software technology talent development. By providing a roadmap that harmonizes competencies with job demands, higher vocational institutions can better equip their students with the essential skills and knowledge demanded by the industry. This transformative approach ensures that future software technology talents emerge as dynamic, versatile professionals, ready to meet the challenges and complexities of the ever-evolving technological landscape head-on. In essence, Gong (2020)'s work offers a path towards enhancing the cultivation of software technology talents, bolstering the capabilities of higher vocational institutions, and shaping the future of the software industry.

In a remarkable study, (Li, 2016) delves into the dynamic landscape of professional competence required by IT enterprises. Employing a mixed-method approach comprising interviews, hierarchical analysis, and questionnaires, Li (2016) skilfully gathers and analyses data through descriptive statistics, unravelling invaluable insights. The research's findings artfully illuminate the intricate relationships between enterprise needs and professional competence, method competence, and social competence. Discerning patterns emerge, revealing that IT enterprises attach the utmost importance to practical ability within the realm of professional prowess, emphasizing problem-solving capabilities in method ability, and placing a premium on professional ethics in social competency.

The conclusions drawn from this comprehensive analysis bear significant implications for the future training of computer software technology talents. Armed with a clearer direction, educators and institutions can proactively tailor their training programs to cultivate professionals who possess the precise set of skills and attributes most coveted by IT enterprises. By fostering a generation of adept and ethical software technology talents, the study sets the stage for a workforce better equipped to tackle the challenges and opportunities of the ever-evolving IT industry. Li (2016)'s research emerges as a beacon of guidance, fostering a harmonious alignment between the demands of the market and the abilities of aspiring professionals, fostering a mutually beneficial relationship for both IT enterprises and the talents that power their innovation and success.

In their cutting-edge research, Zhao (2011) embarked on a data-driven journey, utilizing job website information as their source and harnessing the power of advanced crawler technology to extract and analyse talent demand patterns. The result? A comprehensive and detailed portrait of software technology professional talent, encompassing both basic and specific attributes. At the foundational level, the study revealed the essential basic attributes that shape the landscape of software technology talent. These attributes encompass critical information such as years of work experience, the number of available positions, and the cities where these positions are in demand. Unravelling these fundamental aspects provided a solid groundwork to understand the dynamics of the job market for software professionals.

Yet, delving deeper, the study went beyond the basics and meticulously enumerated specific attributes that characterize software development expertise. These attributes comprehensively listed the knowledge and skill points crucial to excel in various software development directions. Furthermore, Zhao (2011) astutely distinguished between individual and team-level professionalism, shedding light on the distinctive attributes possessed by software professionals both as individual contributors and as integral team members. The research's methodical approach and detailed findings offer invaluable insights for talent seekers, job applicants, and educational institutions alike. By capturing the intricacies of talent demand and the specific skills sought by the industry, the study provides a roadmap for aspiring software technology professionals to tailor their expertise and stay relevant in a rapidly evolving landscape. In essence, Zhao (2011)'s work shapes a dynamic future for software technology talents, optimizing their career trajectories and empowering them to thrive in the ever-changing world of technology. The realm of software technology programs in China encompasses

numerous universities, each striving to equip students with the necessary skills for a thriving career. As a focal point of this study, Luoyang Vocational College of Science and Technology stands as a shining example—a key discipline construction major among Henan Provincial colleges and universities. To understand the current state of talent training, this study delves into the following crucial aspects.

Unreasonable Curriculum

Within a considerable number of higher vocational colleges, the curriculum design for software technology majors reveals certain flaws, with its extensiveness becoming a prominent issue. Taking the training plan for software technology majors in 2021 as a case in point, vocational ability courses are categorized into three groups: vocational foundation, vocational ability, and ability expansion (Jin et al., 2022; Haibing, 2010). The course offerings encompass a diverse range, including Java programming, C language, Python programming, JavaScript programming language, PhotoShop, Fundamentals of aesthetics, software engineering, computer network, and more. While the array of subjects may appear comprehensive, the curriculum suffers from a lack of depth in certain areas, leaving students with an overwhelming and fragmented learning experience. The implications of these findings warrant attention, as a curriculum that is both well-structured and in-depth holds the key to nurturing proficient software technology talents. Addressing the issue of course load and ensuring a balanced focus on core competencies can substantially enhance the training outcomes, empowering students to graduate as skilled and adaptable professionals ready to make a tangible impact in the ever-evolving software industry. As the study progresses, it will shed further light on additional aspects of the current status of Luoyang Vocational College of Science and Technology's software technology major, opening avenues for improvement and excellence in talent development.

The essential "dual-teacher" role within software technology majors demands instructors with a distinguished level of software expertise for effective teaching, while also possessing the prowess to guide students in hands-on research projects and software equipment construction (Chunbo, 2021). In terms of professional knowledge, teachers must demonstrate the capacity to proficiently teach two or more courses within software development majors. Moreover, in the realm of expertise, they should exhibit the ability to effectively instruct two or more courses within related professional disciplines of software development, actively contributing to the design and formulation of comprehensive course syllabi by leveraging their mastery of diverse subject matters. Regrettably, the current composition of the teachers' team in our university reveals several critical aspects deserving of attention. A staggering 78.9% of teachers in this major hail from fresh graduates of colleges and universities, resulting in a single source of recruitment and a lack of practical experience within enterprises. This limitation undermines the holistic development of students, as real-world exposure and insights are crucial for nurturing future-ready software professionals.

Another pressing concern lies in the shortage of teachers' awareness of the broader context. Many instructors demonstrate inadequate understanding of the significance of their professional services to society and industry, failing to fully grasp the potential of fruitful industry-university cooperation that could elevate the quality of education and produce more industry-relevant graduates.

Furthermore, the teachers' career planning and development remain ambiguous, lacking clear trajectories for growth and professional advancement. Establishing a clear roadmap for career progression is vital to foster an environment where teachers can continually improve their expertise, ultimately contributing to a richer and more stimulating learning experience for students.

Addressing these shortcomings in the teachers' team is paramount to cultivating a thriving and dynamic software technology program. By recruiting experienced and versatile professionals, fostering a strong sense of awareness, and providing opportunities for career development, the university can nurture a faculty of "dual-teachers" who truly inspire and empower students, shaping a generation of software technology talents ready to lead and innovate in the ever-evolving technology landscape.

The School of Information and Digital Engineering, housing the esteemed major of software technology, faces a notable challenge in the realm of practical training. Within this domain, three key aspects warrant attention. Firstly, the training base predominantly comprises computer rooms, tailored primarily for basic teaching

purposes. While this serves as a foundation, it falls short when it comes to providing students with opportunities for hands-on experience on enterprise-class projects. As a result, students may lack exposure to real-world scenarios, hindering the full development of their practical skills.

Secondly, the scarcity of computer resources at the college poses a hindrance to practical course arrangements. The 1:1 ratio between students and practical training remains an elusive goal due to resource constraints. As a consequence, students may not receive the immersive practical training required to bridge the gap between theoretical knowledge and practical application.

Furthermore, the simplicity of on-campus practice training settings raises concerns. Relying heavily on campus-based training fails to fully leverage the benefits of off-campus training bases, leading to a missed opportunity to expose students to diverse industry environments and scenarios.

To address these shortcomings, comprehensive research on talent development in the field of software technology emerges as a vital next step. By delving into best practices from other institutions and industry leaders, the study can gain valuable insights to inform innovative solutions. Considering the dynamic nature of the technology industry, the research should explore emerging trends and skill requirements, ensuring that the talent development approach remains agile and adaptable.

The study can also explore potential collaborations and partnerships with leading IT companies and enterprises, creating opportunities for students to engage in real-world projects and gain exposure to cutting-edge technologies. By forging strong industry ties, the school can enrich its practical training offerings and bolster students' readiness for the job market.

In conclusion, a thorough examination of the challenges posed by insufficient practical training, followed by strategic research on talent development, will pave the way for the School of Information and Digital Engineering to strengthen its software technology program. With a renewed focus on immersive practical training and industry collaboration, the school can empower its students to become skilled and innovative software professionals, ready to embrace the challenges and opportunities of the ever-evolving digital world. The study is guided by two research questions:

1. What are the issues faced by the graduates in transforming courses learnt in universities into their work place?

2. What are the expectations of the corporate leaders of the graduates whom they have employed?

METHODOLOGY

In the present investigation, a method of qualitative investigation was used. In accordance with Taylor et al. (2015), qualitative research seeks for insight into the value that people assign to items in their lives by collecting information that is descriptive regarding individuals' statements and actions. It seeks to comprehend the human experience by exploring participants' issues in transforming courses learned in universities into their work place and the expectations of the corporate leaders of the graduates whom they have employed based on talent development in software technology specialisation at vocational colleges, specifically in Luoyang Vocational College of Science and Technology, and presenting phenomena from their perspectives (Varutharaju & Ratnavadivel, 2014). This was qualitative descriptive research. A qualitative case study is an approach to research that allows for the exploration of a phenomenon, and in this study, the phenomenon refers to the issues that graduates face in meeting the needs of their employers and the expectations of corporate leaders at work (Suri, 2011). According to Yin (2003), a case study design must take into consideration the following factors: (a) the aim of the investigation is to respond to "how" and "why" questions; (b) the researcher is incapable to alter the behaviours of those participating in the study; (c) you want to look into the circumstances that surround because you believe they are relevant to the phenomena under study; or (d) the boundaries within the setting and the issue under study are unclear. Miles and Huberman (Miles & Huberman, 1994) refer to the situation as "a phenomenon of particular kind occurring in a bounded context." The case represents "the effect, your unit of analysis" (p. 25). The study was carried out at Luoyang Vocational College of Science and Technology in a specific province in China. These alumni were picked because they had acquired and accumulated expertise at

the universities. As a result, the researchers were interested in delving deeply into the challenges that graduates faced in transforming the courses and majors they took during their university years that have helped them in their current jobs, determining which courses are most useful for employment, and which courses need to be added and improved.

Participants

In the present investigation, a purposeful sampling technique was used. Purposeful sampling aims to find important sources from the field whom can give valuable information (Suri, 2011). Eight graduates volunteered to participate in this study, and all had one to four years of industry experience. Their vast experience in the sector offers academics with a great prism through which they can convey the genuine concerns and challenges faced by graduates. Ten business or enterprise executives were selected and interviewed. These 10 company or enterprise leaders freely participated in the investigation. Additionally, there was a need to interview the corporate or enterprise leaders to know their expectations of these graduates in terms of the gaps between the training objectives of professional talents and the needs of enterprises in the industry, the quality, ability and knowledge of the curriculum system and the quality and ability requirements of the enterprises, and whether or not the graduates' knowledge in terms of the teaching content of the core curriculum meet the requirements.

Table 1 illustrates information such as the graduates' current position, employer's details, quality, ability and knowledge requirements of the job.

Table 1 Information gathered based on student's information

N0.	Name	Gender	Major	Graduation time	Workplace	Employment unit name	Employment Opportunities	Working years	Nature of employment unit	Current Salary
1	FSY	Male	Software Technology	June 2023	Beijing	CEC Jinxin Software Co.	Network Operation and Maintenance Implementation Engineer	1	Limited Liability Company	5000-6000
2	BYN	Male	Software Technology	June 2018	Hangzhou	Zhejiang Starting Line Technology Co.	Development	2	Private companies	Above 8000
3	SW	Male	Software Technology	June 2020	Hangzhou	Government Procurement Cloud Co.	Development	2	State-owned enterprises	Above 8000
4	HYB	Male	Software Technology	June 2017	Luo yang	Ruyang County Family Planning Service Center	Operations & Maintenance	4	State-owned enterprises	5000-6000
5	YZC	Male	Software Technology	June 2021	Xi'an	China soft International	Development	1.5	Listed Companies	Above 8000
6	SBH	Male	Software Technology	June 2022	Beijing	Beijing Ximin Huixin Information Technology Co.	Development	1	Private companies	Above 8000
7	CHY	Male	Software Technology	June 2017	Beijing	Beijing Box Network Technology Co.	Operations & Maintenance	4.5	Private companies	5000-6000
8	ZJY	Male	Software Technology	June 2021	Beijing	Beijing Haoguang Garment Co.	Graphic Design	1.5	Private companies	6000-7000

Table 2 illustrates information such as the corporates' company name, business location, business scope, industry and business type.

Table 2 Corporates interview information table

No	Company Name	Business Location	Business Scope	Industry	Business Type
1	Yun Tu Zhi Lian Technology Group Co.	Luoyang	Software development, technology services, technology promotion	Science and technology promotion and application services	Limited Liability Company
2	Microsoft (China) Co.	Beijing	Microsoft ecology and a series of development and promotion	Software and Information Technology Services	Limited Liability Company
3	Microsoft Cloud & Mobile Incubation Program Incubation Center for Entrepreneurship and Innovation	Zhengzhou	Innovation and Business Incubation	Science and technology promotion and application services	Limited Liability Company
4	Zhengzhou Zhongzhichuang Co.	Zhengzhou	Information technology consulting services; software development; technology services	Education	Limited Liability Company
5	Beijing Huasheng Jingshi Information Technology Co.	Beijing	Technology development, technology services, technology consulting;	Software and Information Technology Services	Listed Companies
6	Beijing Jiuqi Software Co.	Beijing	Technology development of electronic computer software, hardware and external equipment	Software and Information Technology Services	Listed Companies
7	China Aerospace Science and Technology Group Co.	Beijing	Various types of space vehicles, space transportation systems and other development, testing, production, sales and services	Science and technology promotion and application services	Limited Liability Company
8	Danet Group Beijing Training Base	Beijing	IT Career Education Talent Services	Education	Listed Companies

Data Collection

The information needed for this study were gathered from a single source, a semi-structured interview. This study includes two instruments: semi-structured interview protocol and an interview content verification form that experts may use to validate the instruments. The researchers created the semi-structured interview methodology and guiding questions based on key components of previous studies. The semi-structured protocol includes open-ended inquiries on challenges that graduates encounter as well as corporate expectations. After the interview methodology had been developed, two qualified individuals were selected to

evaluate the instrument. The experts concurred on the queries they supplied, and just a few minor grammatical errors required to be fixed.

In the present research, we employed semi-structured interviews to collect information from eight graduates and ten company leaders. The framework methodology allows researchers to employ a variety of methodologies for analysis, enabling themes to emerge both inductively (through the lens of study participants' ideas and experiences) and deductively from earlier studies. Comprehensive analysis based on the researchers' extensive assessment of participant replies, an evaluation based on a variety of conditions, and agreement on recurring themes emerged. The researchers transcribed all of the interviews and thoroughly reviewed the transcripts. The transcripts were read numerous times to become familiar with the complete dataset. The researchers then individually coded all of the transcripts. The researchers reviewed all of the open-coded transcripts together. Through agreement and discussion, a set of codes was formed. The stages of interpreting, carrying out, and expanding the analytical framework were repeated until no new codes were generated. The final framework had two categories divided into thirty-two topics. All of the tables are designated as themes and excerpts.

Semi-structured interviews with graduates and corporate leaders were performed face-to-face. Graduates and corporates were approached previously by email and told of the study's goal. After obtaining the participants' agreement to engage in this study via interview, the researchers devised an interview technique to gather further information about the issues faced by graduates and the expectations of corporations. The interview procedure, based on recognised ideas and previous investigations, was validated by two experts.

Data Analysis

The interview transcripts were initially thoroughly transcribed. The acquired data was analysed and categorised correctly. The data analysis procedure had been carried out in line with the description provided by Creswell and Poth (2018), which involved arranging the data, performing an initial database search, categorising and coding the themes, displaying the data, and developing an interpretation. The aforementioned actions create a chain reaction of tasks comprising analysis of information and visualisation that are linked together. Triangulation was employed to boost trustworthiness by integrating several data collection approaches, such as interviews to ensure that the data and supporting evidence utilised in the findings were consistent. In addition, by providing the interview transcript to the participants and requesting that they check its legitimacy. To guarantee accuracy and bias control, members were screened to validate their validity. The data was analysed thematically.

This section presents the study's findings, focusing on how the graduates made use of courses learnt in their years at the university and transforming courses learnt in universities into their work place and the expectations of the corporate leaders of the graduates whom they have employed.

1. What are the issues faced by the graduates in transforming courses learnt in universities into their work place?

2. What are the expectations of the corporate leaders of the graduates whom they have employed?

RESULT AND DISCUSSION

Table 3 shows themes that emerged based on the graduates' interviews personal skills, communication and coordination, continuous learning, professionalism, technology, proactive, teachers' role, depth of learning, emphasis on technological application, knowledge on technical recruitment, enhancing communication skills, enhancing practical learning opportunities, communication challenges in professional development, closing the gap between theory and practice, and effective customer communication as illustrated in Table 3.

Table 3 Themes emerged based on the graduates' interviews

Name	Employment unit name	Themes	Excerpts
FSY	Network Operation and Maintenance Implementation Engineer	-Personal skills -Communication and coordination	(1) importance of personal skills (2) importance between communication and coordination
BYN	Zhejiang Starting Line Technology Co.	-Continuous learning -Professionalism	(1) Strong foundation, active mind, more practice; (2) Professionalism needs to be strengthened;
SW	Government Procurement Cloud	-Technology	(1) knowledge in technology

	Co.	-Proactive	(2) Willing to explore, learn, and study;
HYB	Ruyang County Family Planning Service Center	-Teachers' role -Depth of learning	(1) Teachers to guide students' interest in the curriculum; (2) Knowledge taught in schools is relatively superficial;
YZC	China soft International	-Emphasis on technological application -Knowledge on technical recruitment	(1) Companies pay more attention to technology, technology should be excellent (2) Understand more about the technical recruitment needs of different companies in the industry
SBH	Beijing Ximin Huixin Information Technology Co.	-Enhancing communication skills -Enhancing practical learning opportunities	(1) Students' ability to express themselves should be improved (2) Need to improve more practice exercises
CHY	Beijing Box Network Technology Co.	-Communication challenges in professional development -Closing the gap between theory and practice	(1) Poor communication skills and different ways of expression, which affect the development of the position (2) Insufficient practical application of professional courses offered
ZJY	Beijing Haoguang Garment Co.	-Effective customer communication	(1) the work done cannot communicate well with customers, the ability to express communication is very important

Themes emerging from interviews with students clearly suggest that the most important trait for graduates to be successful in their careers is their ability to develop good personal and communication skills.

Personal Skills and Enhancing Communication Skills

The graduates agreed that personal skills are essential for them to operate well in the job. Good personal skills may lead to graduates' communication abilities, ensuring that messages are conveyed effectively and without misunderstanding, hence increasing workplace efficiency.

Communication and Coordination

When it comes to operating at peak levels at work, graduates cite a significant relationship between communication and coordination. When graduates interact well with their colleagues, their relationships grow and work coordination improves.

Continuous Learning

BYN said that continuous learning is compulsory for graduates and this can be attained by having strong foundation, active mind, and more practice at the workplace to improve productivity. Continuous learning efforts in the workplace may boost engagement among workers, satisfaction with work, and expertise preservation. To be competitive, companies have to continually adjust to ever-shifting economic and social circumstances. Since the achievement of a company is contingent upon its workforce, it's crucial that employee competencies evolve.

Professionalism

Graduates are expected to show case high level of professionalism by being productive, maintain effective work habits, manage time effectively, demonstrate high level of integrity, be proactive and exhibit abilities to solve problems at the workplace. When graduate students take on tasks that have a direct impact on communities, it's crucial for them to understand the importance of their positions and the amount of social responsibility required.

Technology

Graduates are also expected to show mastery in technology. Knowledge in technology is important for graduates to perform at the workplace. Students approaching the current workforce must be prepared for the modifications that lie ahead. This includes being versatile and willing to learn new abilities, as well as keeping up with the newest technology as well as business trends. It's also crucial to think about the moral consequences of technology and how it's employed in the workplace.

As graduates join today's workforce, they should recognise the value of continuous education. The swift pace of technological development implies that the expertise and comprehension necessary for many occupations are continually developing, making it critical to remain ahead of the curve. This entails always open to new chances to acquire knowledge and professional growth.

Proactive

Graduates must show their best abilities to learn, be proactive and perform at the workplace to increase productivity. Graduates are expected to be proactive at the workplace to ease and take up the challenges they face when they are assigned with specific tasks.

Teachers' Role

Graduates explained that they need guidance from the teachers towards the curriculum they were exposed in. It is through the teachers' roles only the graduates will be able to learn and master the theoretical aspects that can be transformed at the workplace.

Depth of Learning

Another significant challenge centres around the cultivation of practical skills during professional training. Graduates SBH and BYN highlighted the general lack of emphasis on practical ability development, noting that theoretical knowledge often revolves around basic concepts, with limited exposure to real-world enterprise scenarios. These concerns point to a gap between skill practice in academic settings and its practical application in the industry. On the other hand, the successful implementation of enterprise project practice teaching in Jiangsu Electronic Information Vocational College Software Technology in 2014 is a noteworthy example of how practical training can yield positive outcomes, evident in a remarkable employment rate of over 97% and a student satisfaction rate exceeding 90% in 2017 (Rong et al., 2021).

Emphasis on Technological Application

Graduates are additionally anticipated to be technologically proficient. Graduates must have knowledge of technology in order to function well in the industry. Students entering the modern workforce must be prepared for the changes that are ahead. This involves being adaptable and eager to learn new skills, as well as being current with the latest technology and business trends. It's also important to consider the moral implications of technology and how it's used in the workplace.

Knowledge on Technical Recruitment

Graduates are expected to have strong research skills, which are essential for related to technology recruiters because they allow them to maintain up to date on industry developments, find applicants successfully through different avenues, comprehend the dynamics of the market for comparisons strategies, completely screen prospective employees by examining their professional history and online presence of mind, and understand the company.

Enhancing Practical Learning Opportunities

One of the prominent issues uncovered is a disconnect between the curriculum offered in higher vocational colleges and the actual demands of the market whereby the knowledge taught in schools is relatively superficial. This mismatch is evident in the supply of technical talents not aligning with the demand in the industry, leading to a gap in meeting specific job requirements. Feedback from graduates' interviews highlighted concerns from students such as HYB and CHY, who expressed that certain course contents are taught shallowly and lack practical relevance. They pointed out the need to eliminate or replace specific courses that do not directly contribute to practical applications, such as CSS3, JQuery, and BootStrap, while emphasizing the importance of Web front-end technologies like HTML5, JavaScript, and VUE framework in real-world scenarios. Furthermore, graduates FSY, YZC, and SW underscored the critical importance of students' technical mastery abilities in the job market.

Communication Challenges in Professional Development

Graduates should equip themselves with the 21st century learning skills required to be able to help to face communication challenges in professional development. This is important because graduates

Closing The Gap Between Theory and Practice

Unveiling yet another critical concern, the research found that professionalism cultivation among software technology graduates requires focused attention. Of the 8 students interviewed, a significant majority—5 students, accounting for 62.5%—highlighted the paramount importance of communication skills in their professional journey. Meanwhile, 7 out of the 10 interviewed enterprises emphasized the significance of professionalism in potential candidates, shedding light on the specific attributes they value most. These aspects include language expression and communication abilities, a strong inclination towards self-learning, innovative thinking, hands-on prowess, as well as a practical, serious, and responsible work attitude (Yi Han & Ai Hua, 2011 & Ji Yuan, 2019). Evaluating the curriculum of the major, it was evident that while the training of skills received ample emphasis, the cultivation of vocational literacy took a backseat. This gap raises the need for a comprehensive strategy to bolster professionalism training among students.

Effective Customer Communication

Graduates are expected to deliver effective customer communication at the workplace. They are just now expected to be proactive but they are also required to entertain and provide good service to their customer.

Feedback from the Corporates

Table 4 demonstrates themes emerged based on the corporates' interviews namely emphasis on soft skills in employment promoting technological proficiency, emphasis on personal attributes in employment, empowering students for product leadership, holistic professionalism, communication proficiency in product management, holistic expertise in employment, vision and initiative in employment, ethical and dedicated work force, multidimensional problem-solving skills in industry, good knowledge, professional knowledge, students' practical exercises, thinking skills, professional and learning abilities, aligning curriculum with technological advancements and problem-solving skills in practical learning.

Table 4 Themes emerged based on the corporates' interviews

Name	Company Name	Themes	Excerpts
YT_SMZ	Yun Tu Zhi Lian Technology Group Co.	-Emphasis on soft skills in employment -Promoting technological proficiency	(1) Companies value personal qualities such as students' thinking skills, ability to deal with problems, stability and character. (2) Technology is the hard currency and the basis of establishment, and more efforts should be made to strengthen practice.
WR_GBS	Microsoft (China) Co.	-Emphasis on personal attributes in employment	(1) Student character and the ability to deal with problems are considered more important by companies.
WR_XF	Microsoft Cloud & Mobile Incubation Program Incubation Center for Entrepreneurship and Innovation	-Empowering students for product leadership	(1) Students are expected to have the ability to drive product-based operations as well as product delivery.
ZZC_ZYJ	Zhengzhou Zhongzhichuang Co.	-Holistic professionalism	(1) Students' professionalism contains various aspects such as attitude, responsibility and ability, all of which are more valued by enterprises.
ZZC_HLJ	Zhengzhou Zhongzhichuang Co.	-Communication proficiency in product management -holistic expertise in employment	(1) Companies value students' communication skills, especially in the area of product management. (2) Companies value the student's broad professional knowledge.
HSJS_ZYH	Beijing Huasheng Jingshi Information Technology Co.	-Vision and Initiative in employment -Ethical and dedicated work force	(1) Companies are more willing to hire graduates who have ideas and goals. (2) Students' professionalism such as loyalty and responsibility are more valued

JQRJ_LX	Beijing Jiuqi Software Co.	-Multidimensional Problem-solving skills in industry	(1) Businesses consider students' business thinking, product thinking, engineering thinking, and logical thinking to be important.
DN_FZ	Danet Group Beijing Training Base	-Good knowledge -Professional knowledge	(1) A solid foundation in the profession. (2) A deeper mastery of professional depth.
ZZC_WSB	Zhengzhou Zhongzhichuang Co.	-Students' practical exercises -Thinking skills -Professional and learning abilities	(1) To strengthen students' practical exercises. (2) Exercise students' thinking skills. (3) Solid foundation of professional skills and strong self-learning ability.
ZZZ_ZLJ	Zhengzhou Zhongzhichuang Co.	-Aligning curriculum with technological advancements -Problem-solving skills in Practical learning	(1) The basic courses are arranged in a more substantial manner, and the advanced knowledge needs to be more in line with the current technology direction. (2) Practical work will encounter a variety of bugs, students need to have the ability to solve problems.

Emphasis on soft skills in employment promoting technological proficiency

YT_SMZ stated that organisations emphasise personal attributes such as students' critical thinking capabilities, problem-solving abilities, stability, and character. YT_SMZ also stressed the importance of technology as the hard currency and foundation of establishment, stating that greater efforts should be made to develop practice.

Emphasis On Personal Attributes in Employment

The second business leader, WR_GBS, revealed that firms prioritise student character and problem-solving abilities. Graduates must instil components of their own characteristics in order to communicate ideas critically, give answers to workplace difficulties, develop innovations for sustainability, and satisfy consumers.

Empowering Students for Product Leadership, Holistic Professionalism

The third corporate leader, WR_XF, from Microsoft Cloud & Mobile Incubation Program Incubation Centre for Entrepreneurship and Innovation claimed that students are expected to have the ability to drive product-based operations as well as product delivery.

Communication Proficiency in Product Management

ZZC_ZYJ from yje Zhengzhou Zhongzhichuang Co, puts emphasis on students' professionalism that contains various aspects such as attitude, responsibility and ability, all of which are more valued by enterprises. Attitude is important in defining a graduate's role, approach and demeanour at their workplace towards their colleagues. A positive attitude raises innovation, confidence, motivation, cooperation, and flexibility for the graduates when they encounter challenges. It accommodates the mood for a positive and conducive work atmosphere where eagerness and commitment prosper.

Holistic Expertise in Employment

ZZC_HLJ from the Zhongzhichuang Co, put focus on company's value students' communication skills, especially in the area of product management. ZZC_HLJ said that companies value the student's broad professional knowledge. The reason for ZZC_HLJ focusing on the significant that companies show on graduates' vast professional knowledge is due to companies' expectation on graduates who have good mastery on numerous facets based on their expertise. The vast knowledge foundation allows graduates to come up with informed decisions, familiarise to ever-shifting challenges and issues, and lead to meaningfully to companies aims.

Vision And Initiative in Employment

In the words of HSJS_ZYH, firms are beginning to search for candidates that not only have strong technical skills but additionally display innovation, imagination, and an unambiguous sense of mission. Graduates who

are able to communicate their thoughts and goals are seen as significant resources with the potential for generating inventiveness, changing the culture of an organisation, and ensuring long-term achievement.

Ethical And Dedicated Work Force

Companies are more willing to hire graduates who have ideas and goals. Students' professionalism such as loyalty and responsibility are more valued by companies. Therefore, graduates need to focus more developing their sense and skills for ethical and dedication for work.

Multidimensional Problem-Solving Skills in Industry

JQRJ_LX from Beijing Jiuqi Software Company said that businesses consider students' business thinking, product thinking, engineering thinking, and logical thinking to be important. Most importantly, companies respect graduates' entrepreneurial conceiving, including knowledge of market conditions, customer requirements, and planning for success. Professionals possessing excellent business aptitude are more capable to recognize possibilities, develop successful company plans, and promote long-term success throughout their organizations.

Good Knowledge and Professional Knowledge

Having a good basis in the work place is similar to providing the foundation upon which a meaningful profession can prosper. This will require getting basic skills, competencies and knowledge that proves as the bedrock of proficiency in a specific company or industry. These bases include an inclusive comprehension of main fundamentals, approaches and concept related to the profession. It will include drastic study, rich experience, and on-going learning to make sure competencies and mastery on main fields. So, by doing this, graduates can be more confident and ready to face the issues and challenges and take up opportunities in their selected profession.

Students' Practical Exercises

ZZC_WSB from the Zhengzhou Zhongzhichuang Company claim that it is important to strengthen students' practical exercises. Practical exercises provide a link connecting theory and execution, helping students to apply conceptual knowledge and acquire practical skills required for achievement in the field they have chosen. Practical experiences like experiments in the lab, modelling, initiatives, and apprenticeships provide students with vital knowledge, expertise, and trust when implementing philosophical ideas to everyday situations.

Thinking Skills

ZZC_WSB from the Zhengzhou Zhongzhichuang Company put emphasis on the professional and learning abilities Exercise students' thinking skills. To develop students' thinking abilities, immerse them with assignments and challenges that encourage mental procedures including analysing, synthesising, assessments, and innovation. Teachers inspire students to investigate many viewpoints, discover inventive solutions, and make educated judgements by assigning thought-provoking projects, problems, cases, and problems from the real world.

Professional And Learning Abilities

ZZC_WSB from the Zhengzhou Zhongzhichuang Company discussed on the solid foundation of professional skills and strong self-learning ability. A strong foundation of professional abilities acts as the basis upon which people develop their livelihoods and traverse various occupations. It entails a thorough grasp of the fundamental concepts, rules, and procedures applicable to a certain subject or sector. People who acquire foundational skills and competences build the framework for competence, creativity, and influence in the field they have selected.

Aligning Curriculum With Technological Advancements

ZZZ_ZLJ said that the the basic courses are arranged in a more substantial manner, and the advanced knowledge needs to be more in line with the current technology direction. The choice to improve the content of fundamental courses demonstrates a realisation of the critical role they play in moulding students' knowledge and competency. By upgrading fundamental courses, colleges and universities want to offer students with a solid foundation in basic ideas, principles, and abilities required for success in the field they have selected. Subjects such as mathematics, physics, language arts, and other fundamental disciplines serve as the foundation for higher understanding.

Problem-Solving Skills in Practical Learning

ZZZ_ZLJ said that the practical work will encounter a variety of bugs, students need to have the ability to solve problems. Practical work provides an opportunity for students to apply theoretical knowledge in real-world contexts, acquiring important practical skills and perspectives. But this practical knowledge usually comes alongside a variety of complications, such as bugs, failures, and unexpected roadblocks that might hinder development and success. In such cases, students must be able to detect, analyse, and solve issues in a timely manner.

Addressing these challenges requires a comprehensive approach that aligns educational offerings with industry needs, emphasizing practical applications, and fostering technical mastery among students. By incorporating industry-oriented projects and bridging the gap between theory and practice, higher vocational colleges can produce graduates better equipped to thrive in the dynamic and competitive software technology landscape. Moreover, initiatives like enterprise project practice teaching serve as successful models to guide other institutions in cultivating highly skilled and employable software technology talents. By addressing these identified problems and adopting successful case studies, educational institutions can position their graduates to excel and lead in the ever-evolving software industry.

DISCUSSION

To address the identified challenges and pave the way for a transformative talent development approach, the study proposes a series of strategic measures.

Conduct Teaching Plan Reform, Revise Curriculum System, and Strengthen Professionalism Training

The key to driving effective change lies in a teaching reform that aligns with market demand and equips graduates with essential skills. To this end, the curriculum system of the software technology program can be revised to cater to the diverse nature of courses and enrich their content. Adopting a "ladder" approach, the curriculum can be divided into primary, intermediate, and advanced courses. At the primary level, emphasis should be placed on vocational literacy courses and general ability development. Intermediate courses must correspond to job-specific abilities, encompassing core courses aligned with enterprise demands and further enhancing vocational literacy. As students advance, they can explore extended ability courses, allowing them to delve into high-precision professional training or alternative skill directions. Crucially, professionalism courses should be thoughtfully integrated across all three stages, providing a cohesive and continuous focus on nurturing well-rounded and highly professional graduates.

By implementing these strategic measures, the software technology program can effectively address the challenges identified in the research, fostering graduates who are technically skilled, professionally adept, and industry-ready. Such a transformative approach will not only meet the demands of the dynamic software industry but also empower students to excel and thrive in their careers as valued contributors to the ever-evolving technology landscape.

Strengthening Practical Training

Recognizing the pivotal role of practical training in cultivating students' professional and technical application abilities, the need to emphasize practical teaching becomes apparent (Chengguang, 2005). Building upon the

modified "ladder" curriculum, practical training is thoughtfully divided into "three steps" to foster a well-rounded skill set in students.

The first step focuses on primary skills practice, employing a "case-based" approach to cultivate students' foundational skills and reinforce their grasp of fundamental knowledge. This step lays a robust groundwork for their journey into the world of software technology.

Moving on, the second step entails intermediate skills practice, adopting a "comprehensive project" approach. This phase benefits from the guidance of "double-teacher" instructors within the school, harnessing the potential of large-scale projects to foster an immersive learning experience.

The third and final step embraces advanced skills practice, entailing a "business scenario" approach. Here, collaboration with partner enterprises allows students to be matched with second instructors, immersing them in authentic business scenarios for practical application. This real-world exposure equips them with the expertise and confidence needed to excel in a professional setting.

Embracing a dual-pronged approach, the interview design of this study strategically addresses both graduate perspectives and enterprise insights. By capturing the experiences and perceptions of graduates and juxtaposing them with the expectations and viewpoints of industry players, the study nurtures a holistic understanding of the challenges and opportunities inherent in the software technology talent landscape. This comprehensive methodology lays the foundation for evidence-based recommendations and actionable strategies, paving the way for effective talent development initiatives that harmoniously align with the ever-evolving needs of the software industry.

The research encompasses interviews with a total of ten enterprises, out of which eight interviews were successfully conducted. These interviews encompassed four enterprises based within the province and an additional four from outside the province, all hailing from the information technology industry (Yue et al, 2011). Employing a flexible and insightful semi-structured approach, the interviews sought to delve into various perspectives on talent requirements and expectations.

Analyzing the compiled data, intriguing insights surfaced from the interviews with 8 graduates. Among them, 5 students emphasized the equal significance of both professional skills learning and vocational skills, highlighting the importance of a well-rounded skill set. One student expressed dissatisfaction with the perceived superficiality of the knowledge taught in school, emphasizing the need for more in-depth education. Another student underscored the paramount importance of communication skills in vocational settings. Conversely, one student recognized the value of communication skills while emphasizing a longing for greater practicality in the professional courses offered at the institution.

Delving into the results of the enterprise interviews, 4 out of the 10 interviewees emphasized their requirements for students to possess both professional skills and vocational competencies, further emphasizing the need for a comprehensive skill set. Five enterprise personnel stressed the significance of professionalism in potential candidates, signalling the importance of soft skills and conduct in the workplace. Interestingly, one enterprise personnel solely mentioned their emphasis on skill requirements, underscoring a particular focus on hands-on capabilities.

CONCLUSION

The amalgamation of these valuable perspectives lays the groundwork for informed and strategic talent development initiatives. By recognizing the diverse expectations and preferences of both graduates and enterprises, the research presents an opportunity to bridge the gap between educational offerings and industry demands. Armed with this comprehensive understanding, educational institutions can fine-tune their curriculum and focus on nurturing graduates equipped with the multifaceted skills sought after by employers. Ultimately, this harmonious alignment between academia and industry will empower aspiring professionals to excel and contribute significantly to the dynamic landscape of the information technology sector.

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