



Research article

The effect of core competencies of university students on employment and first year salary level based on school activity log

Eunju Yi ^a, Do-Hyung Park ^{b,*}^a Graduate School of Business IT, Kookmin University, Seoul, South Korea^b School of Management Information Systems / Graduate School of Business IT, Kookmin University, Seoul, South Korea

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ABSTRACT

Deciding on a career and securing employment at an ideal company represent significant challenges for students. Employment is not only a personal achievement but also a measure of success for universities and governments. To transform students into competitive applicants, various activities are provided by universities, governments, and companies. These activities may leave students either excited about the prospects or overwhelmed by the experience. The aim of this study is to explore the relationship between college experiences and post-graduation employment through an analysis of a five-year activity log. Specifically, students' diverse activities were categorized into six core competencies: skill reinforcement, leadership and teamwork, globalization, organizational commitment, job exploration, and autonomous implementation. We used logistic regression to examine how these competencies relate to employment status, and ANOVA analysis to assess their impact on initial salaries. The findings reveal that while competencies in skill improvement, job exploration, and organizational commitment were not statistically significant, those in leadership and teamwork, globalization, and autonomous implementation were crucial for securing employment. Additionally, globalization, job exploration, and autonomous implementation competencies influenced annual salary levels. Furthermore, a comparison of students completing either a single major or a convergent major revealed that job exploration competency significantly impacts the annual salary level.

1. Introduction

Students are inherently curious about their careers and life after graduation. With society and technology evolving rapidly, job opportunities are becoming increasingly diverse, segmented, and specialized. Consequently, students are challenged with making career decisions and often require additional time to fulfill the specific job requirements listed in job descriptions [1]. Recent 2019 statistics from the South Korean government show that over 50% of students choose to take a leave of absence or grace periods before graduating. This decision is aimed at enhancing their skillsets and competitiveness in the job market. Additionally, the onset of career preparation has shifted to earlier academic years, with students beginning their job qualification efforts as early as their freshman or sophomore years.

As highlighted by Steffy et al. [2], the initial employment contract significantly influences one's future career status and income. Conscious of this, students are dedicating considerable time and effort to their career preparation, often feeling overwhelmed by career

* Corresponding author.

E-mail address: dohyungpark@kookmin.ac.kr (D.-H. Park).

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choices. Therefore, it is crucial for students to evaluate the value of educational activities in supporting their future careers before engaging in them, thereby conserving energy, time, and resources. Universities are increasingly playing a pivotal role in enhancing students' job prospects [3]. They are implementing comprehensive career development programs, offering counseling and coaching sessions to empower students in proactively shaping their successful careers [4,5]. These initiatives include mandatory classes focused on career exploration, internship opportunities, student exchanges, and hackathons.

While extensive research has been conducted on the factors influencing career decisions [6,7], our study bridges a specific research gap. We focus on analyzing students' logged activities, using employment status as a quantitative metric and wage levels as a qualitative metric, to gain a more comprehensive understanding of post-graduation outcomes. Previous studies have explored the relationship between college activities that facilitate job searches and subsequent career outcomes [8,9], as well as the impact of various attributes including degree, major, credits, English proficiency, licenses, awards, and their influence on career outcomes [10]. Notably, Nie et al. examined data related to campus life, such as library usage, dormitory access, on-campus expenditure, and academic achievements, in the context of career choices [7]. Denise and Michael have identified significant factors that affect student employability [11]. Our research, however, distinguishes itself by extracting and analyzing six core competencies from extensive school activity data, assessing their relationship with both quantitative (employment status) and qualitative (initial annual salary) outcomes.

This study aims to utilize real data from student activity logs and outcome data (employment status and initial annual salary) to explore the development of career planning and counseling programs. The paper is organized as follows: Section 2 offers a review of relevant literature and presents hypotheses based on the Six Core Competency Model. Section 3 outlines the research design and methodology, while Section 4 presents the empirical findings, including hypothesis testing and discussion. Lastly, Section 5 discusses the implications and conclusions of the study.

2. Theoretical background and hypothesis

2.1. Career development of university students

According to the eight stages of Psychosocial Development [7], university life typically falls within the fifth stage, encompassing approximate ages between 12 and 22. In Korea, this stage has been extended due to the constricted job market and mandatory military service for men. Erikson [12] noted that this stage is significant because it often marks a delay in launching one's career. Adolescents in this age group, who may feel uncertain about their role in impending adulthood, often experience feelings of depression and anxiety. They focus on their self-perception and how others perceive them, pondering over the differences. Additionally, they seek role models and ideals for the future, questioning how the skills and roles they are learning today will manifest in their future lives, and they may encounter various crises. During this time, their experiences extend beyond home and school to the broader society. Erikson, who identified key tasks to be addressed at each stage, pinpointed self-identity as the crucial challenge during adolescence. The establishment of a positive self-identity in this period is vital as it influences mutual recognition, willpower, determination, role expectations, and lifestyle. If one experiences unhappiness during this period, it can become a pivotal moment in their life, potentially leading to feelings of helplessness, isolation, and skepticism.

According to a recent study, since the post-industrial era of the 1990s, the time required to prepare for a job has lengthened [13], making it more challenging to achieve both employment and financial stability. Moreover, individuals in their 20s need to adopt a different perspective than those in the past, due to the psychological turmoil brought on by concerns about life, self-identity, and societal roles. Despite this, the correlation between the activities derived from a college student's school experience and their resulting sense of self-identity remains significant. This period, characterized by instability and identity exploration, offers a unique opportunity for students. It is a time when competition for jobs can be enriching, as they strive to understand themselves and their environment beyond individualism and parental influence, experiencing positive growth that supports their self-identity [14]. Conversely, if this period leads to standardized and monotonous experiences, it can harm individual dignity and result in a waste of national resources.

In the United States, which acknowledges the significance of college students' career development on quality of life and the creation of national human resources, the National Career Development Guidelines (NCDG) were established. These guidelines offer competency-oriented career development strategies at every educational level, from elementary school to adulthood [5]. This competency-based approach, contrasting with a job-based approach, aligns with the direction of our study as it focuses on individual development and capacity building.

2.2. Competency

Competence is an individual characteristic linked to excellent job performance [15]. It encompasses the internal characteristics of an individual, such as motivation, traits, self-concept, knowledge, and skills [16]. The initial approach to competency emerged in the 1920s with the introduction of rational management techniques. Prior to this approach, managers maintained a strict separation from workers, monitoring and controlling employees to maximize efficiency. However, this led to worker dehumanization and a corresponding decrease in productivity. Subsequently, from the 1960s onward, the distinct boundaries between capitalists and workers began to blur. Workers were provided with vocational education and training opportunities for personal growth [17], and the concept of 'competence' became widely recognized.

McClelland [18] defined competency as not only related to work performance but also encompassing psychological and behavioral characteristics in a broader sense that are applicable to life. Its meaning has evolved to generalize and conceptualize the behavioral

characteristics of excellent performers, including knowledge, skills, and abilities. This approach has been actively adopted in the fields of corporate education and human resource management worldwide.

Spencer [16] likened competency to an iceberg. He observed that skills and knowledge, representing the visible part of the iceberg above sea level, have a high potential for development. In contrast, traits such as self-concept, personal characteristics, values, and motivation, which are hidden below sea level, exhibit a lower potential for development. Oh [19] argues that in our increasingly complex society, high-level and integrated thinking skills are essential. He notes that it is challenging to clearly identify the causal relationship between competency and performance in the modern world, as outcomes are often the result of combined and associated jobs from multiple fields. As a result, he categorizes competency into two areas: job competency and interpersonal competency, emphasizing the importance of a balanced consideration of both. In this context, for managers on a production line, job-oriented competency may be more critical, whereas for sales managers, human-centered capabilities assume greater importance.

In the corporate field, Peterson [20,21] discovered that technical knowledge, cognitive ability, social capital, and expertise in a central bank governors' discipline impact financial stability. Regarding project success, communication, commitment, and leadership emerge as the most relevant aspects among the 28 project manager competencies.

2.3. *Convergence major*

According to the US National Foundation, convergence is defined as the deep integration of knowledge, techniques, and expertise from different fields to create novel and expanding solutions for scientific and societal challenges [22]. Convergence in academia and education is actively implemented because traditional curricula are no longer effective, while convergence, alongside new technologies and approaches, facilitates the creation of new knowledge [23]. This concept was first introduced in education in 2003, coinciding with the publication of the book 'Converging Technologies for Improving Human Performance: Nanotechnology, Biotechnology, Information Technology, and Cognitive Science' [24]. Although the areas of convergence are unlimited, typical combinations in education include integrating content from health, society, humanities, business, and the arts with practical scientific disciplines like physics, engineering, mathematics, and computing [24]. In the Department of Business Administration, for example, the convergence of Management of Information and Systems, Finance Management, Organizations and Personnel Management, Human Resource Management, Strategy and International Management, Technology Management, and AI Management with specific domains has been effectively implemented. More specifically, management tailored to specific industries is also prevalent, including Logistics Management, Distribution Management, Shipping Management, Hotel Management, Tourism Management, Hospital Management, Sports Management, Event Management, Arts Management, Farm Management, NGO Management, and E-business Management. As technologies and industries evolve, new types of management are being developed, each aiming to meet the specific and practical needs of a field. Consequently, graduates with a convergence degree from a business department are regarded as having a comprehensive understanding of both business and another specific technology, body of knowledge, or industry.

2.4. *Six core competency model*

The Korean government standardized the skills required for job performance in the industrial sector and announced the National Competency Standards (NCS) in 2002. The aim of this initiative was to enhance national competitiveness by increasing the efficiency of human resource management and development, and fostering a competency-oriented society rather than one focused solely on academic credentials. Companies can use these standards not only in their recruitment, education, and training of prospective and current employees, but also in systematically executing talent development. Additionally, the NCS is intended to enhance the sustainability of university education in relation to industrial sites. This takes into account the resources and time required to train new employees, regardless of the increasing specificity of college graduates' qualifications.

Lee [5] identified seven basic vocational subdomains and their elements using data from the Education Science Research Technology Department in Germany and the US Ministry of Education and Trade. These subdomains represent essential vocational skills to be acquired at the university level: resource utilization ability, interpersonal relationship ability, information processing ability, organizational management ability, self-development ability, technology application ability, and multicultural understanding ability. However, our research indicates that the ten competencies suggested by the National Competency Standards (NCS) — communication ability, numeracy ability, problem-solving ability, self-development ability, resource management ability, interpersonal ability, information ability, technical ability, organizational understanding ability, and work ethic — do not fully encompass the competencies developed through school activities, including globalization. Moreover, one activity may relate to multiple competencies. We also identified limitations in Lee's [5] seven basic vocational competencies, as they focus on the 'capabilities' individuals currently possess rather than the 'competencies' they could develop in the future through learning and training. Additionally, these competencies do not consider students' autonomous activities during the school day. Specific abilities, such as resource utilization, span several competency areas, making it challenging to classify students' activities as mutually exclusive (MECE). To clarify the relationship between school activities, as independent variables, and employment outcomes, as dependent variables, we determined that maintaining a single, clear connection under the MECE framework is crucial. We also assume that each activity enhances specific competencies, influencing dependent variables, including qualitative aspects like employment and quantitative aspects like initial annual salary. Furthermore, we considered the K-CESA, implemented by the Korea Vocational Competency Development Institute since 2011, which focuses on six competencies: communication competency, interpersonal relationship competency, global competency, comprehensive thinking ability, self-management capacity, and resource/information/technology utilization capacity. However, K-CESA, being a core competency diagnostic tool for college students measured by a text-based test, presented challenges in measuring and classifying college

Table 1
Definition of six core competency.

	Six Competency	Definition	Example of experience
Organizational performance competency	Skill improvement	The ability to learn knowledge, skills, attitudes, etc., as required by the job, in line with the demands of society and career plans based on collected career information	Acquisition of licenses, credits, contest awards, and job-related external training, etc.
	Leadership & teamwork	The ability to collaborate effectively to achieve a group's purpose, either as a leader or a follower	Participation in club activities, academic societies, student council activities, volunteering, etc.
	Globalization	The ability to speak foreign languages, understand multiculturalism, world history, international values and attitudes, and collaborate and discuss with people from different cultures	Participation in exchange student programs, overseas internships, international projects, overseas volunteer activities, and obtaining official foreign language scores, etc.
	Organizational commitment	A sense of pride in the organization, loyalty, adherence to rules, duty, interest in the group to which one belongs, and volunteer activities within the affiliation	Participation in Homecoming Day, sports competitions, freshmen orientation volunteer activities, and updating personal information in the school system, etc.
Self-development competency	Job exploration	The ability to establish, advance, and modify career plans based on career management information search (job, company, industry, organizational culture, etc.) and self-exploration (strengths and weaknesses, interests, personal values, etc.)	Participation in job fairs, special lectures, group counseling programs, 1:1 counseling, and career diagnostics
	Autonomous implementation	Activities driven by inner motives such as interest and curiosity, and unrelated to one's job	Setting up a startup, participating in events or volunteer activities of external organizations



Fig. 1. The underlying mechanism from competency level to job market success.

students' activities into competencies for human resource management, as human experience encompasses a variety of competencies. Therefore, a new set of competencies, derived from university students' activities, was needed.

To investigate how school activities impact students' post-graduation outcomes using life log data from their school days, we identified six core competencies (refer to < Table 1 >). These include four competencies required by organizations for an individual to become a successful employee (skills improvement competency, leadership & teamwork competency, globalization competency, and organizational commitment competency) and two competencies that are meaningful and essential for a satisfactory life before the start of a career (job search capability and autonomous capability).

The mechanism by which the six core competencies of college students, proposed in this study, affect the quantitative and qualitative outcomes of employment is as follows (refer to < Fig. 1 >). Diverse activities experienced by students during their college years contribute to the development of one of the six competencies suggested in this study, as indicated by Bassellier et al. [25]. This research posits that the more experiences students have, the higher their competency levels will be, which in turn is advantageous for employment. Moreover, we hypothesize that higher competency levels make individuals more desirable to employers, potentially leading to higher salaries. Accordingly, this analysis seeks to establish the relationship between school experience and employment status first, and then between school experience and salary level. In the second analysis, we attempted to discern qualitative differences among employed graduates, despite the limitations of data and resources, and the challenges of gathering additional information through interviews. Despite these constraints, using the first annual salary as a qualitative performance variable has the advantage of being clear, continuous data, suitable for ANOVA analysis.

2.4.1. Skill improvement competency

Competency-based recruitment has been established in the United States and the United Kingdom due to their diverse and dynamic cultural and business environments, influenced by geographical and demographic factors. Recruitment focused on job competency quickly fills gaps in the workforce for companies. It facilitates the management of necessary human resources, helps reduce corporate costs and risks, and enables the execution of strategic human resource management [26]. Korean companies previously inferred successful recruitment from applicants' information, such as physiognomy, speech, writing performance, university level, and authorized English test scores. However, companies are now increasingly seeking candidates expected to align with specific job responsibilities. In Korea's job market, courses aimed at enhancing English proficiency, traditionally seen as leading to highly paid jobs, have always been a top priority, with 33.1% of students enrolling in these courses [27]. Digital Chosun Inc., a popular news media in Korea, reported that in 2021, the top priority shifted to obtaining certificates in major fields, with 49.4% of students taking these courses. The second priority is improving resumes and interview skills, with 30.5% of students enrolling in relevant courses. The third priority, English proficiency, now sees 24.9% student participation. This shift indicates that job skill improvement is increasingly emerging as a significant concern and practical need for students preparing for employment [28].

Research on competency in Korea, published in 2002, introduced the National Career Development Guidelines (NCDG) of America

[5]. These guidelines encompass all the knowledge, skills, attitudes, and habits essential for career-related self-knowledge, education and occupational exploration, and career planning. Presented in the form of a map, it was proposed that cultivating the competency of Americans is akin to cultivating America itself. According to the NCDG, human life is categorized into four stages: elementary, middle, high school, and adulthood, with college students falling into the adult stage. In this context, competencies related to self-interest were identified as (1) the ability to maintain a positive self-concept, (2) the ability to exhibit effective behaviors, and (3) the ability to understand developmental changes and transitions. This aligns with the findings of Erikson [9], who posited that a positive sense of self-identity established during a college student's life is crucial for mutual recognition, determination, role expectations, and one's approach to life.

Job search competency encompasses the ability to find, evaluate, and interpret information on potential careers, to understand the impact of social needs and functions on the structure and nature of work, and to initiate education and training. Career planning can be further subdivided into the ability to comprehend the influence of work on personal and family life and to make informed decisions [29]. This entire process, from searching and understanding to evaluating, deciding, initiating, executing, and reattempting in order to achieve a goal, is akin to obtaining an official certificate and being awarded a scholarship for academic excellence during school days.

Applicants with high job-related skill expertise, who possess abilities that companies need to enhance performance, are advantageous for employment and may command higher pay if their skills are valuable to the company. Based on this understanding, Hypotheses 1 and 2 are proposed as follows.

Hypothesis 1. Students with a high level of skill improvement competency are more likely to gain employment than those with a lower level.

Hypothesis 2. Students with a high level of skill improvement competency are likely to receive higher pay than those with a lower level.

Furthermore, due to the inherent nature of convergence majors, applicants with such backgrounds integrate multidisciplinary knowledge and practical skills. They possess a better understanding of the specific needs of the job market, equipping them to excel in various sectors. This broader perspective enables them to identify emerging trends and adapt quickly to new challenges, making them highly sought after by employers. Employers are increasingly recognizing the value of convergence majors, as these graduates bring unique problem-solving abilities and a deeper understanding of the interconnectedness of various industries. Consequently, they may receive higher initial salaries compared to their single-major counterparts. Thus, [Hypothesis 3](#) is also proposed as follows.

Hypothesis 3. The impact of skill improvement competency on initial salary is greater for students with convergence majors than for those with single majors.

2.4.2. Leadership & teamwork competency

Leadership is characterized by the behavioral traits necessary to effectively achieve goals through interpersonal interactions in specific contexts. The concept of leadership has evolved over time. Initially, it was viewed as the ability to command obedience, respect, and loyalty by the sheer will of the leader [30]. It then transformed into a technique for exerting influence through persuasion, evolving further into a power moderated by ongoing interactions [31]. More recently, leadership has been defined as the act of inspiring followers through communication, motivation, and decision-making processes [32]. Contemporary leadership studies in the 21st century describe leadership as a process of mutual growth and influence aimed at effectively achieving goals [33].

Leadership can be examined from the perspectives of both leaders and followers. Characteristics such as a leader's physical, intellectual, and personal attributes, including honesty, initiative, leading by example, and caring behaviors, are often emphasized. The Leader-Member Exchange (LMX) model highlights the importance of a leader's strong sense of trust, emotional connection, and respect for followers [34]. Following this, leadership models tailored to specific situations have emerged, recognizing that one leadership theory may not be universally effective across different conditions [35].

In college life, students often exhibit leadership through involvement in student clubs, community groups, and student councils. This form of leadership demands problem-solving skills, interpersonal abilities, and an understanding of organizational dynamics. Such skills are increasingly important in the era of Industry 4.0, characterized by specialized, diversified, converged, and borderless technologies and job markets. Effective leaders enhance organizational strength by fostering team harmony, both within and across groups, thereby facilitating teamwork [36]. Consequently, applicants with strong leadership and teamwork competencies can augment organizational power through fostering harmony among colleagues and partners, which is advantageous for employment. It is plausible that companies may offer higher compensation to such individuals. Based on this understanding, Hypotheses 4 and 5 are proposed.

Hypothesis 4. Students with a high level of leadership-teamwork competency are more likely to gain employment than those with a lower level.

Hypothesis 5. Students with a high level of leadership-teamwork competency are likely to receive higher pay than those with a lower level.

Moreover, students in convergence majors often participate in interdisciplinary coursework and collaborative projects with peers from various academic backgrounds. These experiences equip them with a distinctive skill set, particularly in leadership and teamwork, which are crucial in the contemporary, rapidly evolving workplace. In the professional arena, there is a growing appreciation for individuals who can lead diverse teams and foster effective collaboration. Collaborative work necessitates strong leadership,

communication, and teamwork skills to bridge the gaps between disciplines and drive innovative solutions. Graduates from convergence majors typically excel in these areas due to their prior experience. Thus, [Hypothesis 6](#) is proposed accordingly.

Hypothesis 6. The impact of leadership-teamwork competency on initial salary is greater for students with convergence majors than for those with single majors.

2.4.3. Globalization competency

According to 2021 data from the Korea International Trade Association, Korea's trade volume ranks sixth globally, following China, the United States, Germany, the Netherlands, and Japan. In 2020, Korea's trade to GDP ratio (calculated as total imports plus exports divided by nominal GDP times 100) was 72.9%, placing it second among the G20 countries, behind Germany at 70.82%. In comparison, the trade dependence of the US and Japan was 19.34% and 28.08%, respectively. This data highlights the scale of Korea's market and its export-oriented economic structure, emphasizing the need for human resources with globalization capabilities.

To strengthen globalization efforts, research has indicated the necessity for college students to develop global competencies [37, 38]. Kim defined globalization competency through several dimensions: 'international thinking', such as the ability to rationally evaluate international issues and citizenship within a global community; 'international understanding', including an appreciation for the diversity of life and cross-cultural equality; 'international values and attitudes', such as contributing to world peace and the common good of humanity; and 'social relationships', encompassing skills like discussion, networking, collaboration, and communication with people from different cultures [39].

The Korea Collegiate Essential Skills Assessment (K-CESA), as announced by the Korea Vocational Competency Development Institute, defines global competency for the globalization era as possessing an international sense and attitude, alongside necessary skills such as flexibility, activeness, knowledge, and understanding of other cultures, as well as comprehension of globalization and economics. Park et al. highlighted open, interactive, and receptive attitudes towards other cultures, along with communication skills and attitudes, as key aspects of global citizenship competencies [40]. Koh and Jung emphasized the importance of foreign language communication skills, attitudes towards embracing world cultures, and global citizenship, which includes an interest in international social problems and solutions, as crucial competencies for the internationalization of university students [41].

Relevant student activities in this context include participation in student exchanges, overseas internships, international projects, volunteer activities abroad, and acquiring foreign language skills. In the increasingly globalized business world, companies aiming to target the global market for expansion and competitiveness seek students with higher globalization competence. Consequently, such students are likely to have an employment edge and may receive higher salaries, leading to the proposal of Hypotheses 7 and 8.

Hypothesis 7. Students with a high level of globalization competency are more likely to gain employment than those with a lower level.

Hypothesis 8. Students with a high level of globalization competency are likely to receive higher pay than those with a lower level.

Furthermore, firms that value globalization competence may prefer applicants with a diverse skill set combining knowledge and expertise from multiple fields. This versatility is essential in addressing complex global challenges, making innovative connections, and adapting to a wide range of tasks. Therefore, globalization competency might be more highly valued in students with convergence majors than those with single majors, prompting the proposal of [Hypothesis 9](#).

Hypothesis 9. The impact of globalization competency on initial salary is greater for students with convergence majors than for those with single majors.

2.4.4. Organizational commitment competency

Organizational commitment refers to an individual's emotional attachment to and engagement with an organization. It denotes a psychological state where an individual not only embraces the organization's values and goals but also exerts extra effort on its behalf. Members with strong organizational commitment are dedicated to performing at a high level within the organization and adhere closely to its core goals, standards, principles, ethics, and values [42].

Allen and Meyer [43] have categorized organizational commitment into three distinct types: affective commitment, continuance commitment, and normative commitment. Affective commitment is akin to pride and loyalty, where members of an organization develop emotional affection and attachment, identifying themselves closely with the organization. It is influenced by factors such as an employee's work experience, the organizational structure and support, and personal characteristics [44]. Research has shown that affective commitment closely aligns with organizational commitment and significantly affects perceptions of task characteristics, turnover intentions, and career satisfaction [45]. Continuance commitment, on the other hand, is driven by economic considerations. The decision to remain with an organization often stems from a lack of alternatives and factors such as the cost of leaving the current job, benefits provided by the organization, risks associated with job turnover, opportunity costs of changing jobs, and the psychological burdens involved [45]. Normative commitment arises from an individual's internal values or beliefs, creating a sense of duty and obligation to the organization. Shim and Jeon [46] noted that normative commitment develops through various factors including home education, socialization from culture and society, organizational values and expectations, and corporate cultural experiences.

Organizational Citizenship Behavior (OCB), which manifests through organizational commitment, involves actions outside of formal duties that support the smooth functioning of the organization. These actions, performed without official reward and not mandated, contribute significantly to organizational health [47]. Organ [48] identified key aspects of OCB, including 'altruism' (helping coworkers in need), 'courtesy' (preventing unnecessary job-related interpersonal conflicts), 'conscientiousness' (consistently

adhering to organizational regulations, rules, and norms), 'civic virtue' (actively participating with a keen interest in organizational matters), and 'sportsmanship' (enduring inconveniences or sacrifices without complaint). Smith et al. highlighted job satisfaction, environmental factors, and personality as determinants of OCB [49].

In university life, activities such as inputting personal information, participating in homecoming days, sports competitions, orientations, and volunteering are indicative of commitment to organizational goals and adherence to its regulations and rules. These activities share a commonality: they are voluntary and align with the organization's objectives. In this study, organizational commitment and OCB are merged into 'organizational commitment competency'. We posit that increased organizational commitment enhances performance and effectiveness [50]. Therefore, it can be inferred that applicants with a high level of organizational commitment competency are more likely to secure employment and potentially receive higher salaries. Hence, Hypotheses 10 and 11 are proposed.

Hypothesis 10. Students with a high level of organizational commitment competency are more likely to gain employment than those with a lower level.

Hypothesis 11. Students with a high level of organizational commitment competency are likely to receive higher pay than those with a lower level.

Furthermore, companies that value organizational commitment often seek employees with diverse skills and the ability to adapt to various roles within the organization. Students with convergence majors, owing to their interdisciplinary backgrounds, can transition seamlessly between different functions, contributing to a versatile workforce. Based on this, [Hypothesis 12](#) is proposed.

Hypothesis 12. The impact of organizational commitment competency on initial salary is greater for students with convergence majors than for those with single majors.

2.4.5. Job exploration competency

The job exploration competency encompasses the entire process of gathering information about various jobs and identifying suitable options [51]. This process includes (a) acquiring information about specific jobs, companies, and industries, (b) understanding one's own strengths, weaknesses, values, and interests, (c) choosing a career goal, and (d) striving to become a person who aligns with that goal. Students often participate in internships and boot camps to gain insights into the unfamiliar realms of jobs, companies, and industries. However, these experiences have limitations in comprehensively covering all companies of interest. Additionally, the scope and depth of work experienced during an internship or within a limited period might differ from that of a full-time role. Therefore, to gain broader knowledge about jobs and companies, students often resort to various sources such as media, friends, consultants, financial reports, company reviews, and job fairs.

With the rapid development of society and technology, setting a career goal has become increasingly uncertain and burdensome. For college students preparing for the future, job searching serves as a significant activity. It is meaningful both passively, as a way to mitigate post-graduation burdens, and actively, as a method to identify and pursue their dreams. Research over the past 20 years indicates that job search activities can enhance employability [51,52]. To aid college students in understanding the professional world, universities and local governments offer special job-related lectures, guest speakers, one-on-one coaching services, job fairs, and practical courses linked with academic credits. Additionally, career development centers, work centers, and consulting services have been established to promote career attitudes, entrepreneurial aptitudes, job preference identification, vocational values, career interests, personality assessments such as MBTI and Enneagram, job search preparation, and career readiness evaluations. From a qualitative perspective on employment, Saks and Ashforth have argued that job search activities are linked to qualitative success in employment [53].

Applicants with high job exploration capabilities are often motivated by a clear alignment between their strengths, goals, and the requirements of their desired job. They actively engage in search activities to understand what companies are looking for, thereby preparing themselves effectively. Consequently, it is postulated that applicants with high levels of job search competency are more likely to secure employment and receive higher salaries compared to those with lower levels of this competency. This understanding leads to the proposal of Hypotheses 13 and 14.

Hypothesis 13. Students with a high level of job exploration competency are more likely to gain employment than those with a lower level.

Hypothesis 14. Students with a high level of job exploration competency are likely to receive higher pay than those with a lower level.

Furthermore, job exploration often involves experimenting with different roles within a company to find the best match. Students with convergence majors bring a diverse skill set and interdisciplinary knowledge, which positions them to excel in problem-solving, innovation, creativity, and team collaboration from a broader perspective. This ability makes them highly adaptable and effective in various roles, leading to the proposal of [Hypothesis 15](#).

Hypothesis 15. The impact of job exploration competency on initial salary is greater for students with convergence majors than for those with single majors.

2.4.6. Autonomous implementation competency

According to the Job Characteristics Theory, Job Autonomy is defined as the extent to which individuals can exercise independence

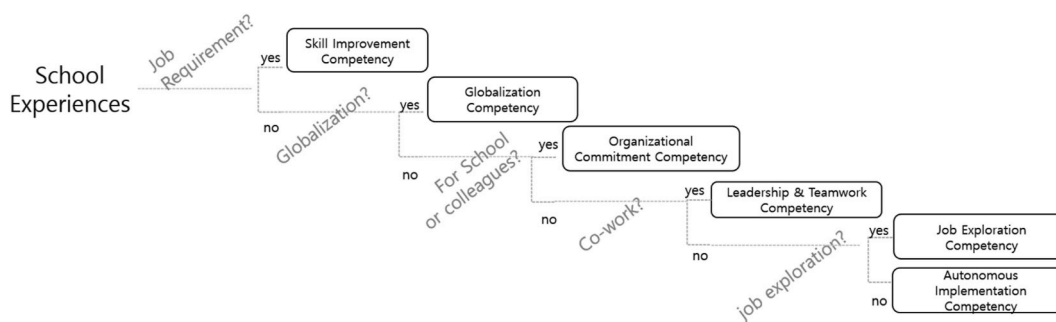


Fig. 2. School experiences classification into six competencies.

and have discretion in how and when they perform their tasks [54]. Job autonomy is not only a resource but also a reward, encompassing decision-making authority, support from superiors and colleagues, and organizational rewards. Bakker [55] identified job autonomy as one of the key job resources in his five-factor theory within Job Characteristics. In the context of college life, autonomy allows students to intuitively pursue their interests, focus their attention, follow their curiosity, and engage with what they deem important. This autonomy fosters intrinsic motivation to take action, even in the absence of direct rewards like employment or academic credits [56,57]. Autonomy has been shown to reduce burnout and enhance work motivation [58–60]. Further research has indicated that job autonomy leads to job satisfaction, which in turn fosters innovative behavior [61], job engagement [62], and the creation of a safer work environment [63].

The impact of autonomy in college life is not just theoretical; it has real-world examples. Steve Jobs, the founder of Apple Inc., mentioned in his Stanford University commencement speech that a calligraphy class he took as a college dropout opened up a new world of aesthetics for him. This experience greatly influenced the creation of various fonts in Apple's early days. Similarly, autonomy in college life enables students to naturally gravitate toward their interests, focus their attention, follow their curiosity, and engage with what they find important. This leads to intrinsic motivation for actions, even in the absence of direct rewards like employment or academic credit [56,57]. Receiving support from the school through various activity programs and personal relationships, including those with professors, seniors, and peers, and personally navigating the process of autonomous implementation can enhance self-understanding and strengthen a positive sense of self-identity [64].

Students with a high level of autonomous implementation competency, characterized by autonomy and self-determination, are proactive in career preparation and possess intrinsic, future-oriented goals. These goals provide motivation, encouraging continuous action, attention, effort, and effective achievement [65]. Intrinsic motivation, driven by self-determination [66], arises from internal factors such as personal values, fulfillment, mission, and meaning. Research has shown that people motivated by intrinsic factors display higher levels of creativity [67], self-development [68], performance [69], and happiness [70] compared to those motivated by extrinsic rewards like wages, praise, and promotion [10,71].

Applicants with a high level of autonomous implementation competency demonstrate the ability to independently execute tasks and adapt to diverse work environments, making them competitive in the job market. Based on this, [Hypothesis 16](#) is proposed. Additionally, these individuals are more likely to receive higher salaries upon employment. This is because employers often recognize and reward self-driven individuals for their potential to contribute to organizational growth, enhance company performance, and reduce the need for extensive oversight. Consequently, we propose [Hypothesis 17](#).

Hypothesis 16. Students with a high level of autonomous implementation competency are more likely to gain employment than those with a lower level.

Hypothesis 17. Students with a high level of autonomous implementation competency are likely to receive higher pay than those with a lower level.

Lastly, students in convergence majors, who integrate knowledge from diverse fields and focus on innovation and creative problem-solving, are well-positioned to drive innovation in cross-disciplinary projects. Their ability to bridge gaps between different disciplines and develop cutting-edge technologies – such as in Biomedical Engineering and Computer Science, Data Science and Sustainability, and Digital Anthropology – is expected to be more pronounced than that of students in single majors, particularly regarding their initial salary. Therefore, [Hypothesis 18](#) is proposed.

Hypothesis 18. The impact of autonomous implementation competency on initial salary is greater for students with convergence majors than for those with single majors.

3. Research design and method

3.1. Independent data collection and preprocessing

This study analyzed data collected from 1061 business administration students at a four-year university in Seoul over a period of

five years. The study received approval from our local Institutional Review Board (IRB) (KMU-202306-HR-365). The students' experience logs were classified into 114 categories. These logs were manually collected and inputted by the school's administration team. The team gathered information by checking the school's IT system, reviewing documentation submitted by students for point allocation, and consulting faculty members about students' attendance at events or recognition of exemplary behavior.

The 114 experience categories were divided into six competencies following a group discussion involving three experts: the Dean of the Business School, a Career Coach, and a Research Design Specialist from the Career Development Center. While this research initially aimed to allocate each activity into a single competency, as illustrated in <Fig. 2>, it was recognized that a single activity often encompasses various competencies. Consequently, an activity could be allotted to multiple competencies with appropriate weighting. The categorization of the 114 activities into these competencies is detailed in [Appendix I](#).

This study examines various competencies among business school students, correlating specific activities with different types of competencies. Firstly, Skill Improvement Competency is linked to academic grades and qualifications. Students submit their certification documents each semester to the administrative department of the Business School. Based on the difficulty level of the certifications, points are awarded and input into the system: 100 points for lower difficulty levels and up to 400 points for higher levels. Thus, students can earn higher scores by either acquiring a greater number of certifications or obtaining higher-level certifications. For Globalization Competency, points are accrued through participation in international programs like foreign student exchange events, overseas program briefings, and cultural interactions with international students. Teaching assistants monitor attendance and report to the administrative office. Students also submit official language certificates, such as DELF, HSK, JPT, OPIC, TEPS, TOEFL, TOEFL-IBT, TOEIC, and TOEIC-SPEAKING. Points ranging from 100 to 400 are awarded based on the scores or grades achieved. Regarding Leadership and teamwork Competencies, students earn 100 points for participating in on-campus activities such as academic societies, clubs, and volunteer work. Those taking on leadership roles in these activities receive 300 points. Lastly, organizational commitment, classified under organizational performance competencies, is measured through actions such as entering residence and home address details in the school system, subscribing to the school's online newsletters, and verifying students' and parents' email addresses. These actions, though inconvenient, are seen as indicators of emotional immersion with the organization, characterized by pride and loyalty, continuous involvement driven by economic benefits, and normative commitment reflecting a sense of duty [43].

In this study, we classified Job Exploration and Autonomous Implementation under the category of Self-development competencies. Firstly, Job Exploration involves activities aimed at better understanding oneself and the professional world, selecting a suitable job, and working towards that goal [51]. For this, we collected data on students recommended by professors for their exceptional participation in career development courses, those who attended recruitment-related seminars, fairs, and programs, and students who conducted post-graduation interviews with seniors and advisors. Autonomous Implementation, on the other hand, measures a student's ability to engage in unique activities driven by personal motivation, regardless of their relevance to graduation or academic achievement. We tracked students who won competitions both on and off campus, participated in special activities recognized by the Dean of the Business School, were involved in start-ups, or had notable achievements featured in on- and off-campus media. These students submitted documentary evidence to the administrative department and were awarded points ranging from 100 to 400 based on their involvement. Since the number of semesters students participated in these activities varied, we accumulated all scores by student ID and activity type, then divided them by the number of semesters of involvement.

Subsequently, we analyzed the variation in each competency. We observed that data from exceptionally enthusiastic students, who had extremely high experience values, skewed the overall average. To address this, we transformed all six activity values into a logarithmic format, ensuring they were distributed between 0 and 1. Furthermore, our research considered the variations in primary competencies that are associated with higher salary levels, particularly examining the differences between single majors and convergence majors.

3.2. Business school curriculum by major type

This study conducted a comparative analysis between traditional Business Administration and Management Information Systems (MIS), which is an integration of business administration and IT. We aimed to explore the differences in log scores and outcomes between single majors and convergence majors.

In the context of the prevailing trends of globalization and digitalization, the primary Business Administration department focuses on guiding students to understand the globalized economy and companies, emphasizing 'Globalization'. It also aims to foster entrepreneurship, encouraging students to create new business opportunities and to embark on business start-ups in both virtual and real-world settings. The curriculum is designed to develop students' international confidence, establishing their self-image and identity. This foundation is expected to nurture immersion, passion, and competency in academics and work, inspiring them to set and achieve goals in new environments.

Conversely, the Management Information Systems (MIS) department is dedicated to developing creative, integrated, communicative talents. This is achieved by converging knowledge from Business Administration, Humanities, and Information Technology. Core courses in this department include Modern Management, Entrepreneurship, Marketing, and Financial Management, building on the foundations of Business Administration. Additionally, students have the option to take courses like English, Business Communication, Production Operation Management, and Accounting Theory.

Both the Business Administration and Management Information Systems (MIS) departments in the Business School offer the 'Seminar in Special Topics' course. This course fosters intellectual curiosity and enhances student-to-student relationships through small group meetings with professors and students. Additionally, there's a 'Capstone Design' project, which involves planning, designing, and executing a project based on the learning acquired at school.

Table 2
Sample size and salary range by salary level (unit: 1,000USD).

Salary Level	1	2	3	4	5	6
Estm. 1st year salary	0–25	25–30	30–35	35–40	40–45	Above
No. of Students	80	110	49	67	38	38

Table 3
Descriptive statistics by six competencies.

	Min.	Max.	Mean	SD
Skill improvement	0	2.167	0.054	0.187
Leadership & teamwork	0	4.500	0.352	0.496
Globalization	0	2.250	0.214	0.287
Organizational commitment	0	3.667	0.626	0.581
Job exploration	0	1.833	0.131	0.193
Autonomous implementation	0	2.000	0.120	0.219

For instance, in the Business Administration Department, students have opportunities to explore investment techniques, marketing solutions for company problems, ERP system operation for increased effectiveness, and HR coaching to understand leadership qualities and capabilities. These experiences bridge the gap between academic learning and the workplace. In the MIS Department, students are exposed to experiences like identifying potential consumer needs through industry, market, and consumer analysis to discover business opportunities, applying methodologies for concept development, creating business items and models for maximizing profits, and drafting business plans.

The primary difference between the two departments is their focus areas. The Business Administration Department deals with overall business management, encompassing company products and services, managers and employees, and internal management. In contrast, the MIS Department focuses on innovative thinking to conserve resources and create new opportunities by analyzing data and understanding people and industries. Details about the mandatory and optional courses, as well as the potential job tracks available in each department, are presented in [Appendix II](#). Salary information for these jobs is not included due to the significant variation within the local environment.

3.3. Dependent data collection and preprocessing

In this study, the primary dependent variable was employment status, representing a quantitative approach, while the first annual wage data were used to provide a qualitative perspective. The employment status variable was categorized in binary form (not employed = 1, employed = 2). To manage large variances, the annual wage values were first logarithmically transformed and then categorized into six levels for analysis, ranging from the lowest (level 1) to the highest (level 6), as shown in [Table 2](#). Furthermore, the six core competencies were classified into two levels (high or low) to facilitate an analysis of variance and to examine the cross-effect by major type (Single vs. Convergence). Descriptive statistics of the points across these six competencies are provided in [Table 3](#).

The employment locations of each student were identified through questionnaires distributed on graduation day or via telephone interviews conducted within one year of graduation. These questionnaires are detailed in [Appendix III](#). For data on the annual salaries of first-time graduates by employment location, we referred to estimated income values based on national pension and health insurance premiums, as well as information from the company information platform Job Planet [72]. While the salary data were sourced from the job platform rather than directly from the graduates, the variation in salaries by position and department within companies in Korea is typically not significant. This is because many Korean companies hire generalists on a rotational basis rather than for specific jobs. Job-based contracts are more common when graduates are employed by foreign companies or outsourcing firms.

The original dataset included records from 1061 students. However, we excluded data from certain outliers to ensure the relevance and accuracy of our analysis. This included data from international students, as their primary job market is not in Korea and they typically do not engage in official school activities. We also removed records of adult students who were already employed full-time upon entering the school and those who did not have any school log records. Additionally, data from students who were insincere in inputting their activity points, pursued graduate studies immediately after graduation, or belonged to groups smaller than 25 students within their departments (making the analysis of variance impractical) were excluded. After these adjustments, the study utilized data from a total of 684 individuals, comprising 382 employed and 302 unemployed students.

4. Results

4.1. Hypothesis test

[Table 4](#) displays the mean values and standard deviations for each competency level, categorized by employment status. To examine the impact of all six competencies on employment, logistic regression analysis was performed. [Table 5](#) presents the results of this analysis, including model fit tests and statistics. The Omnibus test of model coefficients yielded a Chi-Square value of 32.269 on 6

Table 4
Competency levels by employment condition (unemployed vs. employed).

	Skill improvement			Leadership & teamwork			Globalization		
	Unem.	Em.	Total	Unem.	Em.	Total	Unem.	Em.	Total
n	302	382	684	302	382	684	302	382	684
Mean	0.027	0.075	0.054	0.282	0.408	0.352	0.160	0.257	0.214
SD	0.105	0.231	0.187	0.409	0.549	0.496	0.212	0.329	0.287
	Organizational commitment			Job exploration			Autonomous implementation		
	Unem.	Em.	Total	Unem.	Em.	Total	Unem.	Em.	Total
n	302	382	684	302	382	684	302	382	684
Mean	0.515	0.714	0.626	0.106	0.151	0.131	0.084	0.148	0.120
SD	0.484	0.634	0.581	0.142	0.223	0.193	0.184	0.239	0.219

*Unem = unemployed, Em = Employed.

Table 5
Logistic regression results.

Omnibus Tests of Model Coefficients				Chi-Square	Degrees of Freedom	Significance
				32.269	6	0.001
Model Summary				-2 Log likelihood	Cox & Snell R Square	Nagelkerke R2
				993.824	0.042	0.057
Hosmer and Lemeshow Test				Chi-square	Degrees of Freedom	Significance
				12.390	8	0.135
Model Variables	B	S.E.	Wald	Significance	Exp(B)	
Job exploration	0.141	0.078	3.263	0.071	1.151	
Autonomous implementation	0.267	0.081	11.035	0.001	1.307	
Skill improvement	0.145	0.081	3.197	0.074	1.157	
Globalization	0.201	0.078	6.710	0.010	1.222	
Leadership & team-work	0.161	0.076	4.465	0.035	1.175	
Organizational commitment	0.137	0.075	3.344	0.067	1.147	
Constant	0.259	0.076	11.777	0.001	1.296	

Table 6
Salary levels by competency level (high vs. low).

	Skill improvement			Leadership & teamwork			Globalization		
	Low	High	Total	Low	High	Total	Low	High	Total
n	324	58	382	156	226	382	190	192	382
Mean	2.907	3.293	2.966	2.788	3.088	2.966	2.768	3.161	2.966
SD	1.610	1.601	1.612	1.558	1.641	1.612	1.570	1.634	1.612
	Organizational commitment			Job exploration			Autonomous implementation		
	Low	High	Total	Low	High	Total	Low	High	Total
n	155	227	382	171	211	382	210	172	382
Mean	2.768	3.079	2.966	2.743	3.147	2.966	2.795	3.174	2.966
SD	1.556	1.644	1.612	1.528	1.660	1.612	1.578	1.634	1.612

degrees of freedom, significant beyond 0.001. This result effectively rejects the null hypothesis, confirming that including the variables significantly enhances our ability to predict employment.

As shown in Table 5 under 'Model Summary', the -2 Log likelihood statistic is 993.824. This value was used in the Omnibus test, comparing it to the null model, and indicates significant predictability for our model. The R2 values (Cox & Snell and Nagelkerke's) are approximations of the variation in the outcome explained by the model. Specifically, Nagelkerke's R2 value suggests that our model explains approximately 6% of the variation in employment outcomes. The Hosmer & Lemeshow test, with a Chi-Square value of 12.390, indicates a good fit for the model, given its statistical significance greater than 0.05.

The final part of Table 5 presents the regression coefficients (B), standard errors (S.E.), Wald statistics (for significance testing), and odds ratios (Exp (B)) for each variable. The coefficients for autonomous implementation, globalization, and leadership & teamwork are statistically significant at the 0.05 level and positive. This indicates that an increase in these variables is associated with a higher likelihood of employment. For instance, the odds ratio of 1.307 for autonomous implementation implies that for each one-point increase in this score, the likelihood of employment increases by over 130%. Similarly, one-point increases in globalization and leadership & teamwork scores are associated with 122% and 118% increases in employment odds, respectively. The coefficients for job exploration, skill improvement, and organizational commitment are statistically marginally significant at the 0.10 level. Hence,

Table 7
ANOVA test results of salary level by competency level.

	Groups	Sum of Squares	Df	Means Square	F	Sig.
Skill improvement	Between Groups	7.318	1	7.318	2.828	0.093
	Within Groups	983.239	380	2.587		
	Total	990.558	381			
Leadership & teamwork	Between Groups	8.308	1	8.308	3.214	0.074
	Within Groups	982.249	380	2.585		
	Total	990.558	381			
Globalization	Between Groups	14.752	1	14.752	5.745	0.017
	Within Groups	975.805	380	2.568		
	Total	990.558	381			
Organizational commitment	Between Groups	7.185	1	7.185	2.776	0.096
	Within Groups	983.373	380	2.588		
	Total	990.558	381			
Job exploration	Between Groups	15.434	1	15.434	6.014	0.015
	Within Groups	975.124	380	2.566		
	Total	990.558	381			
Autonomous implementation	Between Groups	13.595	1	13.595	5.288	0.022
	Within Groups	976.963	380	2.571		
	Total	990.558	381			

Table 8
Descriptive statistics of six competency levels by major type.

	Major Type		Total (n = 684)
	SM (n = 490)	CM (n = 194)	
Skill improvement	0.048 (0.172)	0.068 (0.222)	0.054 (0.187)
Leadership & teamwork	0.325 (0.489)	0.421 (0.508)	0.352 (0.496)
Globalization	0.226 (0.310)	0.185 (0.217)	0.214 (0.287)
Organizational commitment	0.608 (0.571)	0.671 (0.605)	0.626 (0.581)
Job exploration	0.124 (0.180)	0.150 (0.221)	0.131 (0.193)
Autonomous implementation	0.136 (0.239)	0.081 (0.149)	0.120 (0.219)

Note: SM, Single Major; CM, Convergence Major.

Table 9
Descriptive statistics of salary level by competency level and major type.

Competency Level	Skill improvement		Leadership & teamwork		Globalization	
	SM	CM	SM	CM	SM	CM
Low	2.84 (1.556) n = 244	3.10 (1.762) n = 80	2.72 (1.523) n = 121	3.03 (1.671) n = 35	2.72 (1.545) n = 142	2.92 (1.648) n = 48
High	3.18 (1.507) n = 34	3.46 (1.744) n = 24	3.01 (1.565) n = 157	3.26 (1.804) n = 69	3.06 (1.543) n = 136	3.41 (1.827) n = 56
Competency Level	Organizational commitment		Job exploration		Autonomous implementation	
	SM	CM	SM	CM	SM	CM
Low	2.79 (1.530) n = 117	2.84 (1.653) n = 38	2.76 (1.517) n = 121	2.70 (1.568) n = 50	2.68 (1.512) n = 145	3.05 (1.700) n = 50
High	2.96 (1.567) n = 161	3.38 (1.795) n = 66	2.98 (1.575) n = 157	3.63 (1.815) n = 54	3.11 (1.568) n = 133	3.41 (1.846) n = 54

Note: SM, Sing Major; CM, Convergence Major.

hypotheses 4, 7, and 16 are supported, while hypotheses 1, 10, and 13 receive marginal support.

In this part of our analysis, we focused on the impact of the six competencies on salary levels. Out of the 684 graduates, we selected 382 who were employed for this analysis. These 382 graduates were divided into two groups based on each competency level (high and low), with the median value serving as the dividing line. However, the distribution in some competency groups was skewed, as many elements clustered around the median value.

Table 6 presents the mean values and standard deviations of salary levels according to the competency level. Table 7 shows the results of the ANOVA test, revealing that three out of the six competencies were statistically significant. Specifically, graduates in the higher salary bracket demonstrated higher values in globalization (supporting hypothesis 8), job exploration (supporting hypothesis 14), and autonomous implementation (supporting hypothesis 17). As a result, hypotheses 2, 5, and 11 were rejected, while hypotheses 8, 14, and 17 were supported.

This finding partially aligns with the results of Jeong et al. [8], who found that factors like credits, TOEIC scores, internships, and

Table 10
Two-way ANOVA test results of each competency and major types on salary level.

		Type III Sum of Squares	df	Mean Square	F	Sig.
Skill improvement	Major Type (A)	3.296	1	3.296	1.274	0.260
	Skill improvement (B)	5.439	1	5.439	2.102	0.148
	A x B	0.008	1	0.008	0.003	0.956
	Error	978.181	378	2.588		
	Total	4351.000	382			
Leadership & teamwork	Major Type (A)	5.391	1	5.391	2.086	0.149
	Leadership & teamwork (C)	4.796	1	4.796	1.856	0.174
	A x C	0.065	1	0.065	0.025	0.874
	Error	976.697	378	2.584		
	Total	4351.000	382			
Globalization	Major Type (A)	5.703	1	5.703	2.224	0.137
	Globalization (D)	13.120	1	13.120	5.116	0.024
	A x D	0.444	1	0.444	0.173	0.678
	Error	969.482	378	2.565		
	Total	4351.000	382			
Organizational commitment	Major Type (A)	4.065	1	4.065	1.576	0.210
	Organizational commitment (E)	8.887	1	8.887	3.446	0.064
	A x E	2.389	1	2.389	0.926	0.336
	Error	974.937	378	2.579		
	Total	4351.000	382			
Job exploration	Major Type (A)	6.514	1	6.514	2.570	0.110
	Job exploration (F)	24.890	1	24.890	9.820	0.002
	A x F	9.459	1	9.459	3.732	0.054
	Error	958.085	378	2.535		
	Total	4351.000	382			
Autonomous implementation	Major Type (A)	8.058	1	8.058	3.146	0.077
	Autonomous implementation (G)	11.161	1	11.161	4.357	0.038
	A x G	0.062	1	0.062	0.024	0.877
	Error	968.231	378	2.561		
	Total	4351.000	382			

volunteer work were significant determinants of initial salary amounts, whereas overseas training, qualifications, and awards were not. The partial inconsistency in our findings could be attributed to the different weighting assigned to points per experience and the exclusion of interview elements in our study.

To evaluate hypotheses 3, 6, 9, 12, 15, and 18, we included the type of department major (single vs. convergence) as a variable. Table 8 illustrates the competency levels of all students, segmented by major type. It reveals that, irrespective of employment status, students in convergence majors generally scored higher in skill improvement, leadership & teamwork, organizational commitment, and job exploration. In contrast, students in single majors scored higher in globalization and autonomous implementation competencies. Overall, the data indicated that convergence majors typically exhibited higher competency levels than single majors.

To examine the interaction effects between the major type and each competency, we conducted a two-way ANOVA test. The findings are detailed in Table 9 and Table 10. One notable interaction effect was observed in job exploration, as depicted in Fig. 3. This effect was significantly more pronounced in students from convergence majors compared to those from single majors. This finding underscores the fundamental reason for creating convergence majors: they were designed to meet job market requirements that single majors may not fully address. Job exploration is crucial in helping students understand job requirements, company cultures, industries, and their own values and interests. Preemptively targeting jobs or companies enhances job market readiness for convergence major students, enabling them to find higher-paying jobs and focus on meeting job-specific requirements. Their broad major scope makes them well-suited for specific roles or industries. Additionally, this result might be influenced by the fact that students from Management Information Systems (MIS) with high job exploration competency tend to seek companies at the forefront of innovative Information Systems (IS), driving market growth and typically offering higher salaries.

4.2. Discussion

Through our data analysis, several key insights have emerged. Students who are actively engaged in both local and global implementation and interpersonal interactions tend to secure employment and make job decisions within a year after graduation. This trend highlights a significant correlation: higher levels of competencies in autonomous implementation, globalization, leadership, and teamwork are linked with increased employment rates.

The job market remains highly competitive, especially for top-tier positions. We observed that as students improve their competencies, including skill improvement, leadership and teamwork, and organizational commitment, their salary levels tend to increase. However, there is an interesting pattern where, beyond a certain point, salary levels may start to decline. This phenomenon sheds light on why not all competencies are directly proportional to higher salaries. It appears that students who invest a considerable amount of time, energy, and resources into enhancing their competencies during their college years might choose unemployment if their job expectations are not met. Hence, creating a robust community that provides job information, helps in competency development, and

Job Exploration Competency and Annual Salary Level by Major Type

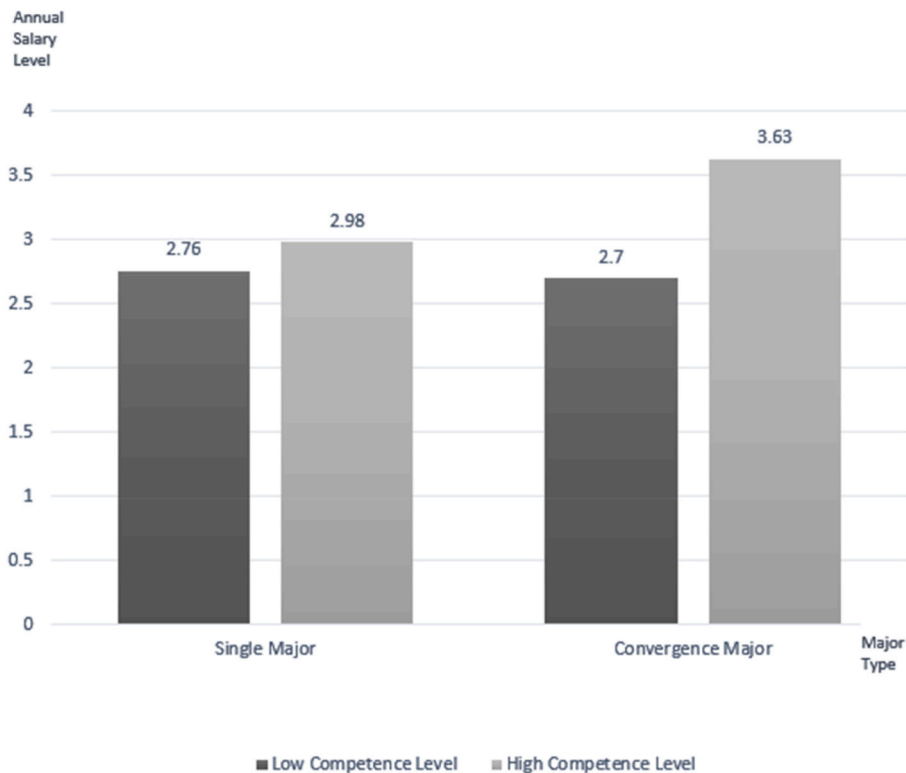


Fig. 3. Interaction effect of Job exploration competency and major type on salary level.

offers mental support can significantly reduce stress among students and facilitate sustainable growth.

Focusing on convergence majors, we found that students with higher job exploration competencies effectively meet the demand for interdisciplinary skills. Companies leading industry and economic growth often offer higher compensation, making convergence majors like MIS more lucrative. However, this does not imply that all convergence majors automatically lead to higher salaries. The difference in pay seems to be more closely related to individual competencies than specific job titles.

In an advanced system, students could tailor their objectives by entering information about their desired job, company, industry, and salary level. Such a system would allow them to track the history of activities and competency levels relevant to their career goals, using data accumulated over the past five years. Additionally, providing information on schedules for competency-related activities and examinations could improve motivation and inspiration among students. By setting specific activity goals based on the experiences of their seniors, students can gain a clearer direction for their academic and professional journey. Moreover, recommendations for activities and timely notifications could help prevent students from missing important deadlines, reducing the administrative burden and enhancing participation rates.

The university years are a pivotal time for students to expand their horizons beyond the standardized education system. The personal values formed during this period play a crucial role in the social and psychological transitions required for adulthood. Engaging in activities that prompt self-reflection and questioning – like identifying personal strengths and weaknesses, understanding global values, and contemplating life goals – is invaluable for students. These experiences help in organizing one's subjective values and achieving a good fit between personal aspirations and career choices.

Therefore, it's advisable to design activity programs that support students in understanding themselves and the working world. These programs should offer a variety of experiences with diverse individuals in different situations, helping students set professional goals aligned with their life ambitions. Implementing job exploration competencies as compulsory subjects across all departments can be beneficial. If provided by schools and governments, these programs could promote social and economic fairness by easing the burdens on students. This approach is particularly meaningful in developing countries, where societal goals often focus on economic development. Standardized goals can suppress creativity and innovation, so a more dynamic approach to education is crucial for fostering development and progress in society.

5. Conclusion

In today's world, where knowledge, science, and technology are highly advanced and specialized, the nature of jobs is evolving. They are becoming more subdivided and specialized, with a growing convergence with IT. This phenomenon has been further accelerated by the pandemic. As the World Economic Forum highlighted in 2020, millions of jobs have been replaced, and an even greater number of new job roles have emerged. This has necessitated a significant portion of the workforce to undergo reskilling, requalification, and upskilling. These rapid changes add burdens and challenges for students who are preparing for employment, particularly those without practical experience outside of school. As a result, the time required to build the desired qualifications for the job market is extending, and the demand for novice qualifications is becoming more pronounced. This can lead to increased complexity, perplexity, and a lack of confidence among students.

Consequently, there is a risk of personal and social waste due to aimless wandering, loss of focus on essential aspects, or excessive preparation for unnecessary details. To address this, our study analyzed log data of college students to examine the relationship between their in-school and out-of-school activities and their employment outcomes. We categorized students' experiences and achievements during their college years into 114 groups, which were then classified into six competencies: skill improvement, leadership & teamwork, globalization, organizational commitment, job exploration, and autonomous implementation. As dependent variables, we collected data on employment status (working and unemployed groups) and salary levels (ranging from 1 as the lowest to 6 as the highest) using manual questionnaires and phone calls. Additionally, this study aims to identify the independent variables affecting wage levels by major type, distinguishing between single and convergence majors.

This approach helps to understand how various competencies acquired during college impact students' employment outcomes in a rapidly changing job market, guiding them towards more effective and targeted preparation for their future careers.

This study offers valuable insights for those interested in educational systems, especially in the realm of competency development and its impact on employment outcomes. System designers at educational institutions will find this research particularly enlightening. It employs a unique methodology that categorizes student activities into six key recruitment competencies and examines their substantial impact on employment. Logistic regression analysis revealed that competencies in job exploration, skill improvement, and organizational commitment were marginally significant, while autonomous implementation, globalization, and leadership & teamwork showed a significant correlation with employment. Furthermore, an analysis using a one-way ANOVA test on employed students' data indicated that high scores in globalization, job exploration, and autonomous implementation competencies were associated with higher salary levels.

An important aspect of this research is its focus on convergence majors, which are increasingly relevant in today's job market. A two-way ANOVA test showed that job exploration competency significantly impacted salary levels in convergence majors compared to single majors. This underscores the increasing importance of convergence majors, where understanding and meeting specific job requirements and descriptions are crucial for success in the job market.

The study also suggests improvements to experience management systems within educational institutions. Automating the logging of activity data using QR codes or smartphones could significantly enhance accuracy and user satisfaction. Real-time tracking and comparison of scores with peers and past graduates could motivate students to engage in activities that enhance their competencies effectively.

Additionally, this research establishes a connection between actual activity logs and outcome data, such as employment and salary levels. Further expansion of outcome variables could include metrics like recency, frequency, and monetary value, offering a broader perspective on educational outcomes.

Finally, incorporating elements like the Net Promoter Score (NPS), which measures loyalty through recommendations [73], could provide a more comprehensive understanding of the impact of educational experiences on students' future endeavors. This approach could significantly enrich the analysis, offering deeper insights into the relationship between educational experiences and subsequent career success.

This research offers valuable insights for those interested in career management, particularly in the context of developing core competencies for organizational and personal success. We identified six core competencies advantageous for both personal and organizational success. Four of these competencies – skill improvement, leadership & teamwork, globalization, and organizational commitment – are particularly beneficial for organizational success. The remaining two, job exploration and autonomous implementation, are crucial for personal success. In today's diverse and customized market, college students, who are accustomed to being consumers, may be more familiar with individual consciousness than a sense of community. Developing competencies for an organization, which involves meeting expectations of others, including people, companies, and society, can be a challenge for students lacking group experience. This study underlines these competencies, encouraging students to recognize and develop the skills they lack. For instance, skill improvement competency, often limited to academic achievements and qualifications, is just one of several competencies for recruitment. We suggest that engaging in a variety of activities, such as job seminars, start-up initiatives, and university protocol adherence, enhances recruitment competencies.

Conversely, a life focused solely on meeting others' expectations without self-reflection can lead to existential questions post-employment. Hence, this study has designed job exploration competency to cultivate self-understanding and goal-setting, and autonomous implementation competency to encourage students to take initiatives beyond job-related rewards. Among the six competencies, three (autonomous implementation, globalization, and leadership & teamwork) significantly influence employment, while the others (job exploration, skill improvement, and organizational commitment) are marginally significant. However, competencies leading to higher salaries are globalization, job search, and autonomous execution. Interestingly, when comparing the impact of student competencies on initial salary between single and convergent majors, job search competency in convergence majors

significantly boosts wages compared to traditional Business Administration Management.

Previous studies have sought to prepare students for employment using real data analysis. These studies often utilized data from counseling sessions to match job vacancies, thereby enhancing student employment rates [8,9]. Additionally, data focusing on quantitative specifications have been employed to examine the relationship between these specifications and students' initial annual salary levels [10]. However, this current study distinguishes itself by incorporating a wider range of activities as independent variables influencing employment outcomes. These activities include volunteer experience, participation in student council, engagement in seminars, involvement in overseas start-up projects, recommendations from professionals in class, and notable activities highlighted by the media. This comprehensive approach enriches the understanding of how various experiential factors contribute to employment prospects, moving beyond the traditional focus on counseling data and quantitative metrics.

This study offers substantial theoretical contributions by integrating the concepts of competency extraction from educational experiences, significant effects of log-outcome relationships, a multifaceted approach to output metrics, and highlighting the distinct value of convergence majors. By meticulously extracting and analyzing competencies from students' activities recorded in school logs, this research aligns these competencies with fundamental principles in Human Resource Management. This alignment not only validates the relevance of school activities to core professional competencies but also strengthens the theoretical underpinnings of on-the-job learning, leadership, teamwork, globalization, organizational commitment, job exploration, and autonomous implementation.

The methodological rigor in assessing each competency through activity log data, analyzed within a robust theoretical framework, ensures data integrity and reduces biases. By employing logistic regression and ANOVA, the study establishes a solid foundation for future research in log analysis, offering a reliable model for categorizing activities and differentiating competencies.

Furthermore, the study advances a comprehensive evaluation of performance metrics, embracing both the quantitative aspect of employment rates and the qualitative dimension of initial annual salaries. This dual approach provides a well-rounded perspective on graduate outcomes, offering critical insights for both students and educational institutions.

Particularly notable is the study's focus on the impact of convergence majors, especially in the area of job exploration competency. This aspect underscores the unique role of convergence majors in today's job market, where interdisciplinary skills and adaptability are increasingly valued. By grounding its findings in these diverse theoretical frameworks, the study not only contributes empirical evidence but also enriches the broader understanding of the dynamic interplay between educational experiences and career pathways, especially for students pursuing convergence majors.

This research offers valuable insights for college students, program organizers, and system designers, emphasizing the practical application of its findings in guiding career development and educational program design. For college students, this study serves as an essential reference for shaping their career development plans. It underscores the significance of developing well-rounded qualifications beyond standardized specifications. The research highlights the importance of understanding oneself, others, and the broader world, demonstrating that such holistic development contributes not only to personal fulfillment but also to potential financial success.

Program organizers, including educational institutions, corporations, and government bodies, can leverage the six competencies identified in this study to design more effective and meaningful experiences for college students. By focusing on activities that develop these competencies, organizers can create programs that yield satisfying outcomes for both participants and providers. The six competencies serve as a blueprint for designing events and experiences that resonate with and fulfill the needs of today's college students. In response to the rapidly evolving job market, the research advocates for the continuous updating of programs to include diverse and non-traditional activities. These might encompass English newspaper reading, international mock conferences, discussions, business case studies, sports, music, and volunteering. By granting points and credits for such activities, educational institutions can motivate students to engage in a broader range of experiences, thereby enriching their education and enhancing their employability.

For system designers, this research offers a foundational approach for advancing log analysis systems. While acknowledging the limitations of the current system, which may not encompass all student activities pertinent to employment, the research suggests areas for improvement. Expanding beyond the 114 categorized activities and the six competencies currently identified, there is potential for incorporating additional activities and competencies that are increasingly relevant in the dynamic job market. Moreover, the study recognizes the need to refine the scoring system and to include more nuanced competencies and activities that, although not formally recognized as school activities, are crucial for employment, such as resume writing, interview skills, job application frequency, and cultivating a positive mindset and vision.

Nevertheless, the limitations of this study, which we acknowledge with a view to fostering further research, are as follows. Firstly, the scope of data collection, restricted to one year post-graduation, may not fully capture the employment trajectories of those who embark on job searches later. This timeframe could limit our understanding of the longer-term impacts of university experiences on employment outcomes. Secondly, our focus on employment status and initial salaries as sole outcome variables could be seen as a narrow interpretation of employment quality. The intrinsic value of a job and personal satisfaction are subjective and multifaceted, influenced by factors beyond mere financial remuneration. Furthermore, the diverse interpretations of 'annual salary' in Korea, ranging from base salary to comprehensive packages including incentives and bonuses, introduce additional layers of complexity to our analysis. Thirdly, and crucially, our study grapples with the challenge of categorizing the multifaceted activities of university students into distinct competencies. The convergence of these activities often blurs the lines between different skill sets, making it challenging to maintain clear-cut divisions. This ambiguity, particularly in the delineation of convergent specialties, suggests that our categorization may not fully encapsulate the nuanced intersections of these competencies. We acknowledge this as a significant limitation, revealing an area where our study falls short in providing a definitive classification of these specialties. Fourthly, the method of manually inputting activity points could have led to the omission of certain activities, particularly those not quantifiable or where students were disinclined to participate in the system or disclose personal information. This limitation points to a potential bias

in the data collection process. Lastly, the process of selecting representative samples from a diverse range of academic majors, both convergent and single, is crucial. However, our study may have inadvertently oversimplified the complex dynamics of these majors, particularly in their relationship to salary outcomes. The choice of MIS and Business Administration students as primary subjects, influenced by data availability and practicality, might not fully represent the broader academic landscape.

In recognizing these limitations, our study underscores the complexity and multifaceted nature of the relationship between university experiences and employment outcomes. As part of our future research endeavors, we propose to expand our analytical framework to include emotional variables and the Motivating Potential Score (MPS) to design a more comprehensive Job Satisfaction Index (JSI). Moreover, a more nuanced analysis could emerge from comparing different employment types (permanent vs. contract), across various industries and company sizes, and through a longitudinal study with students' consent to gain deeper insights into these dynamics.

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Data availability

The data that has been used is confidential.

CRedit authorship contribution statement

Eunju Yi: Writing – original draft, Visualization, Investigation, Data curation. **Do-Hyung Park:** Writing – review & editing, Validation, Supervision, Methodology, Funding acquisition, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix I. Activities Allocations into Competency

Core Competency	Activity Type	Activities in Category	Score	
Organizational Performance Competency	Skill Improvement	Certificate	(35–38) Certificate A Type Level 1, 2, 3, 4	100–300
			(39) Certificate B Type	200
			(40–43) Certificate C Type Level 1, 2, 3, 4	100–400
			(44) Accredited Certificate Others	200
	GPA Achievement	GPA Achievement	(72–73) Excellent Grade A	200–300
			(74–76) Grade Improvement A, B, C	100–300
			(45) Business School Press_Leader	400
			(46) Business School Press_Member	300
	Leadership & Teamwork	Leader-Followership	(47) Business School Protocol	400
			(48) Student Council_Department in Business School_Leader	400
			(49) Student Council_Department in Business School_Member	300
			(50) Business School Student Council_Top Leader	400
			(51) Business School Student Club_Leader	400
			(52) Business School Student Club_Member	300
			(53) Business School Student Academy Society_Leader	200
			(54) Business School Student Academy Society_Member	100
			(55) Student Council_Business School Student Club_Leader	400
			(56) Student Council_Business School Student Club_Member	200
			(57) Student Council_Business School Student Club_Top Leader	400
			(59) University Student Council	200
(64) Extracurricular Group Activities_Leader	200			
Globalization	Global Activities	(16) International Day_Participant	100	
		(17) Overseas program seminar I_Participant	100	
		(21) Overseas program seminar II_Participant	100	
		(65) G-1 Global Buddy	200	
		(66) G-2 Global Buddy	100	
Foreign Language	Foreign Language	(111) Overseas Exchange Student	100	
		(77) French_Delf	100	

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Core Competency	Activity Type	Activities in Category	Score
		(78–81) Chinese_HSK Level 1, 2, 3, 4	100–400
		(82) Japanese_JPT A grade	400
		(83–85) English_OPIC_Level 1, 2, 3	200–400
		(86–88) English_Teps_Level 1, 2, 3	200–400
		(89–92) English_IBT_Level 1, 2, 3, 4	100–400
		(93) English_IBT_Improvement	200
		(94–98) English_Toeic_Level 1, 2, 3, 4, 5	100–400
		(99) English_Toeic_Improvement	200
		(100–104) English_Speaking_Level 1, 2, 3, 4	100–400
		(104) English_Speaking_Improvement	200
		(105) Foreign_Languages_Others	200
	Organization Commitment	(1, 5, 9) Residence and Home Address Input	100
		(2, 6, 10) Business School Press Subscription	100
		(3, 7, 11) E-mail Address input and verification	100
		(4, 8, 12) Parent's Email Address Input	100
		(14) Orientation for Freshman_Participation	100
		(15) Sports Day_Participation	100
		(20) Home Coming Day_Participation	100
		(58) University_Student Ambassador	100
		(60) University_Volunteering	100
		(69) Scholarship_Support for Business School Development	100
Self-Development Competency	Job Exploration	Job information	(13) Career Development Class_Excellent Actives
			(19) Job Day_Participation
			(22) Business School Career Development Center_Participation
			(23) University Career Development Center_Participation
		Competitions for Job Achievement	(24–26) Competition in Univeristy_A Type_Level 1, 2, 3
			(27) Competition in Univeristy_B Type
			(28–29) Competition in University_C Type_Level 1, 2
			(63) Extracurricular Activities Type A
			(106) Extracurricular Activities Type B
		Job Experience	(67) J Scholarship
	Autonomous Implementation	Competitions for Autonomous Implementation	(18) Competition for Start-Up_Type A
			(30–31) Competition out of University_Type A_Level 1, 2
			(32–33) Competition out of University_Type B_Level 1, 2, 3
		Recognition of Autonomous Implementation	(61–62) Extracurricular Activities Recognized by Dean_Level 1, 2
			(68) S Scholarship
			(70) W Scholarship
			(71) A Scholarship
			(107) Excellent Student_Type A
			(108–110) Start-Up in University_Level 1, 2, 3
			(112) Stories posted in the school media
			(113) Stories posted in the out-of-school media
			(114) Public Relations Agents in the out-of-school

Appendix II. Curriculum Organization and applicable Jobs of Single vs Convergence Department in Business School

Type1. Single Major: Business Administration

Tracks	Subjects	Jobs
Prerequisite	Contemporary Business and Entrepreneurship*, Principles of Economics*, Principles of Accounting*, Principles of Marketing*, Business Statistics*, Business English*, Computer Programming*, Financial Management*, Operations Management*, Management Information Systems* etc.	Executive Assistant, Office Administrator, Administrative Assistant, Business Consultant, Business Development Coordinator, Business Manager, Business Coach, Business Planning etc.
Marketing	Principles of Marketing*, Marketing Research, Consumer Behavior, Innovative Product Planning, Price Management, Marketing Communication, Mobile Advertising, Distribution Management, Marketing Channels, Service Marketing, Marketing Strategy, and Design Management etc.	Marketing Coordinator, Brand Designer, Marketing Manager, Corporate Communications Manager, Sports Marketing, Event Marketing Manager etc.

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< Investigating the employment status of graduates >

The purpose of this survey is to investigate the employment status of graduates. All your responses will be aggregated for statistical purposes only, and according to Articles 13 and 14 of the Statistics Law of Korea, complete confidentiality is guaranteed regarding the content of your responses and your identity. Despite your busy schedule, we would greatly appreciate it if you could spare a moment to respond to this survey.

Thank you in advance for your time and cooperation, we wish you good health and fortune. Best regards.

1. What is your year of graduation?
2. What is your age?
3. How long were you in college?
4. Are you currently employed?
- 4.1 If you are employed, what is the name of your company?
- 4.2 What was your initial annual salary?

(continued)

Tracks	Subjects	Jobs
Human Resources Organization	Organizational Management*, Human Resource Management, Comparative Management, Comparative Management, Labor-Management Relations, HR Coaching, International Management, Corporate Ethics, and Strategic Management, Industrial Relations etc.	HR Specialist, Organizational Transformation and Change consultant, Employment Specialist, Human Resources Coordinator, Recruiter, Labor Relations Specialist, Employee Experience Manager etc.
Production Operations Management	Operations Management*, Studies of Management Decision-Making, Introduction to ERP, Logistics Information System, Purchasing Management etc.	Business Process Manager, Business Operations Administrator, Procurement Officer etc.
Financial Management	Capital Market Theory, Financial Institution Theory, Investment Theory, Futures and Options, Insurance Theory, and Insurance Management etc.	Accountant, Financial Analyst, Tax Associate, Fund Accountant, Finance Manager, Business Controller etc.
Accounting	Financial Accounting, Cost Accounting, Management Accounting, Tax Account for Individual/Corporation/Government, Auditing etc.	Bookkeeper, Accountant, Reporting Manager, Accounts Payable Manager, Accounting Administrator, Accounting Technician etc.

Type2. Convergence Major: Management Information Systems

Tracks	Subject	Jobs
Prerequisite	Contemporary Business and Entrepreneurship*, Business English*, Marketing*, Financial Management, Business Statistics*, Principles of Accounting* etc.	Enterprise Digital Specialist, MIS Specialist, Information Systems Manager, IT Manager, Data Scientist etc.
Business System Development Management	Business Software Practice*, Programming I/II*, Introduction to Management Database*, System Analysis & Design, Management Project theory, Management Information Resource Theory, IT consulting, ERP and SCM, Business Process Management Theory, IT etc.	Information Security Analyst, Systems Administrator, Network Engineer, Business Intelligence Analyst, Information Systems Manager, Database Administrator, Network Architect etc.
Business Data Analysis Application	Business Statistics*, Database Practice*, Data Analysis Programming, Data Analytics, Financial Product Investment Information Theory, Social Network Analysis & Application, Business Analytics, Customer Relationship Management, Securities Trading System etc.	IT Analyst, IT Technician, Management Analyst, Data Analyst, Compliance Analyst, Business Analyst etc.
Business Innovation	Principles of Management Information Systems*, Business Strategy & Information Technology*, HCI and UX Innovation, Management Innovation & Information Technology, Digital Business, Technology Management & Social Theory, UX/CX design, and Management & Humanities Seminars etc.	UI/UX Designer, UX Writer, Digital Product Manager, Web Experience Manager, Digital Business Manager, Business Strategy & Initiative Manager, Business Development Manager, Business Transformation Manager etc.

Appendix III. Investigating the employment status of graduates

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