

The Alignment of University Educational Programs with the Professional Standards of the IT Industry

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Abstract

The primary objective of this study is to determine the alignment of university educational programs with the professional standards of the IT industry. Answers to this question were sought through document analysis and convenience sampling. An analysis was conducted to compare the content of educational programs listed in the register with the content of professional standards. The study aimed to identify the most commonly referenced professional standards in these programs and examine their content. A significant challenge in this comparative analysis arises from the absence of a standardized methodological approach to their development. Professional standards were employed in a formal manner without integrating their requirements into the learning outcomes of educational programs. An additional significant challenge lies in the absence of measurability in formulating the requirements for the knowledge and professional skills necessary for the performance of job functions in various professions. A significant proportion of respondents from both stakeholder groups in the survey emphasized the necessity of collaboration to address the challenges related to the comparability of professional standards and educational programs. The findings of this study can serve as a foundation for developing a model for assessing professional skills during their development stages within university programs.

Keywords: *Assessment of qualifications, educational programs, professional qualifications, professional skills, professional standards.*

Introduction

In recent years, Kazakhstan's higher education system has undergone significant reform, with a primary emphasis on transferring the responsibility for validating graduates' qualifications to independent entities. According to the Dossier on the Draft Law of the Republic of Kazakhstan "On Professional Qualifications" (June 2023), which governs the recognition of qualifications, Qualification Confirmation Centers have been established independently of universities.

Previously, graduates' qualifications were verified by State Examination Boards affiliated with universities. These boards primarily assessed graduates' proficiency in core disciplines and evaluated their final projects. The process of qualification confirmation was typically a mere formality, with qualification confirmation being automatically granted upon passing exams or successfully defending

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final projects. Presently, the objective of qualification confirmation at independent centers is to evaluate the preparedness of applicants, including bachelor's degree graduates, for professional roles. These roles are delineated by professional standards (PS) established for occupations in demand within the labor market. While the infrastructure for qualification confirmation is still being fully established, a multitude of professional standards (PS) have been created spanning various sectors of the economy. As an example, there are 25 approved standards uniquely tailored to the IT industry.

Under the new classification of training areas, the traditional concept of "specialty" has been eliminated, and a novel concept termed "Educational Program" (EP) has been introduced. Universities have proceeded to design surveys within various training areas. As an example, within the educational field of 6B06 – Information and Communication Technologies, there exist distinct training areas, including 6B061 - Information and Communication Technologies (ICT), 6B062 - Telecommunications, and 6B063 - Information Security (ISec). Before the reform, the number of IT specialties was limited. However, with the introduction of the new classification, universities began to develop numerous new EPs. Consequently, the primary focus of interaction between the higher education system and the labor market has been to align the methodological foundations for the development and content of two essential documents: Professional Standards for Professions and Educational Programs for Training areas.

This study explores the interaction between the Information and Communication Technologies sector and the related field of education, specifically 6B06, which includes the three aforementioned training areas. The primary findings and questions arising from our research are as follows:

- How closely do the contents of university EP align with the requirements of employers as outlined in the content of Professional Standards for the ICT industry?
- How can these approaches be defined to establish systems for preparing bachelor's degree graduates, who are prospective IT specialists, for the qualification exam and the subsequent recognition of their qualifications?

Literature Review

The theoretical foundation for the reform of Kazakhstan's higher education system is grounded in the competency-based approach. Regulatory documents emphasize the formation of both general and professional competencies among university graduates. Within the Educational Programs (EPs), all outcomes are formulated with a focus on competencies applicable to various sectors of the economy. The article by Zimnyaya (2009) stands as one of the pioneering works providing a comprehensive overview of the stages in the development of a new paradigm and the author's delineation of key competencies. Zimnyaya identifies three primary groups of competencies. These competencies

encompass areas related to an individual's self-perception and identity, their capacity as a life participant, their interactions with others, and their capabilities across a spectrum of human activities, manifesting in various types and forms.

The methodological foundation for implementing the competency-based approach to educational design, as proposed in (Khutorskoy, 2017), revolves around the author's identification of the competency structure necessary for fostering and evaluating competencies. Specifically, within the structure of competence, Khutorskoy incorporates existing knowledge, abilities, and skills pertinent to a specific domain of tangible entities, as well as methods of engaging with this domain, the essential practical experience, and associated performance metrics.

The rationale for presenting competencies and learning outcomes in the EP is explored in a study conducted by Elina et al., 2015. The authors introduce approaches for aligning levels of competence with specific segments and phases of the educational process. One approach involves associating the levels of numerous competencies with the attributes of the training profile.

In a study by Zakirova et al. (2021), Kazakh scientists created a map detailing the alignment of professional competencies, framed as learning outcomes in the EP "Smart city," with the disciplines within the EP. This alignment was carried out by referencing the profession's requirements as articulated in the PS for "Software Development." The content of the disciplines within the EP "Smart City," designed for educating IT master's degree students, incorporated the requisite knowledge and professional skills in accordance with the profession's standards. However, it's important to note that this study did not explicitly illustrate the connection between the learning outcomes and the specific requirements outlined in the PS.

A group of authors, Bowers & Sabin (2022), as well as Bowers et al. (2022), devised techniques for evaluating the competencies of IT professionals. They defined competencies in alignment with the IT2017 document, which is a component of the Computing Curricula 2020 (CC2020) concept document. In this context, competencies are characterized as the sum of knowledge, skills, and aptitudes, with aptitudes denoting personal qualities that are advantageous in the workplace. The primary focus of the authors is on assessing the cognitive predispositions of IT specialists. They propose a method and assessment tool that rely on evidence of task performance in real-world working conditions. This assessment is designed to demonstrate alignment with the responsibility characteristics outlined in the Skills Framework for Information Age (SFIA) and compare them with the provisions of CC2020.

The study by Sabin et al. (2018) addresses crucial aspects of the Curriculum Guidelines for Bachelor's Degree Programs in Information Technology (IT2017), which were developed by The Association for Computing Machinery (ACM) and the IEEE Computer Society. The primary emphasis of this

discussion is not merely on the transfer of IT knowledge but on competency-based learning. The study outlines the IT curriculum's structure, which is designed to align with the evolving demands of the rapidly changing technological landscape. It further illustrates how integrating bachelor's degree programs in IT into student training plans equips graduates with the knowledge, skills, and aptitudes essential for success in the workplace. The focus on competencies is proposed as a means for academic departments to foster collaboration with employers and engage students in practical professional experiences.

In a study conducted by Bowers & Sabin (2023), the objective was to assist educators in assessing students' accomplishments based on the CC2020 dispositions. This was achieved by comparing real-world experiences documented in individual portfolios with the responsibility characteristics outlined in SFIA. The study introduces a tool that facilitates a comparison between the demonstration of SFIA responsibility characteristics and CC2020 dispositions. This tool utilizes a straightforward and consistent evaluation algorithm. The assessment process and its outcomes are demonstrated using a fictitious student portfolio, which was constructed based on one author's observations of student achievements during internships.

In Ukraine, researchers have examined the challenges related to aligning the content of EP in higher education institutions with the requirements of PS in the IT industry (Kovaliuk & Chaikovska, 2018; Kovaliuk & Kobets, 2019). Ukraine has established state standards for six IT specialties, including software engineering, computer science, computer engineering, system analysis, cybersecurity, information systems, and technologies. At the same time, the content of these standards and their methodological basis are constructed based on the Computing Curricula. This approach facilitates development of an EP that aligns with the interests of employers, as IT companies are focused on international documents.

The content of the works conducted in the field of international standardization of IT education is comprehensively detailed in the study by Sukhomlin and Zubareva (2021). The authors identify the following directions in the standardization of methodological foundations for personnel training in this field:

- Standardizing qualification requirements in the IT field, encompassing competencies, skills, and professional role profiles.
- Creating industry-specific body of knowledge (BoK) for diverse IT domains and activities.
- Standardization of the curricula and teaching materials for IT personnel training within the education system.

The authors of the above-mentioned article include the Skills Framework for the Information Age (SFIA) and the European Competence Framework (e-CF) among the most developed and widely used

methodologies and systems for standardizing digital skills/competencies in the field of IT. The primary reference document for curriculum standardization is known as the Computing Curricula. In their study, the authors provide an illustration using the Cybersecurity curriculum, which crafted models of digital cybersecurity skills rooted in the SFIA digital skills concept and the cybersecurity knowledge base.

It's important to mention that the adoption of these international documents in the Russian higher education system is progressing slowly, perhaps due to the existence of Federal State Educational Standards (FSES) and professional standards within the IT industry. These standards are not aligned with international documents and have distinct characteristics.

The article by Russian authors (Zakharova & Kuzenkov, 2017) offers methodological guidance for revising the FSES and choosing professional standards, which have been developed by prominent Russian universities. The analysis evaluated the alignment between overarching job functions and their constituent elements specified in PS and the general professional and professional competencies outlined in the FSES for higher education within the field of training Fundamental computer science and IT. The analysis reveals several correspondences, such as Labor Actions from the professional standards aligning with possessions and skills in FSES, as well as necessary skills in professional standards matching with Skills in the FSES. Additionally, generalized labor functions in professional standards correspond to Competencies in the FSES. It's worth noting that FSES B defines and approves training outcomes for specialty types of professional activity (TPA), professional tasks, professional competencies (PC), and (or) professionally specialized competencies (PSC), as well as general professional competencies (GPC). The availability of such definitions enables the creation of tables that establish connections between the PS and the content of the EP, as all EPs are developed in accordance with the requirements of the FSES for the respective specialty.

The study by Pilipenko et al. (2016) addresses general concerns related to the application of PS in the revision of FSES, presents methodological approaches for developing FSES and sample educational programs based on PS, especially in cases where PS for specific professional activities are lacking. It is noted that within the framework of the regulations, the correlation of the PS and the FSES is performed. This work is performed by specially formed councils for professional qualifications.

Other Russian scientists (Kuznetsova & Repp, 2016) described and analyzed modern mechanisms for coordinating professional and educational standards. The main method involved a systematic analysis of current requirements for the qualification of university graduates by the professional community in the field of IT in the USA, Great Britain, and the Russian Federation. The main result of the study is the conclusion about the need for the effective participation of professional institutes and associations in the formation of higher education standards. It is emphasized that professional

standards should be viewed as a tool that can effectively influence the quality of university training by ensuring sustainable interaction between the labor sphere and the education system (Nwosu et al., 2023; Sevnarayan, 2022; Tshelane, 2022).

In a study by Khabarov et al. (2021), an approach to organizing the educational process is examined, aligning the competencies developed according to the FSES with the key job functions outlined in a specialist's professional standards, along with the requirements for graduates in the labor market.

The list, content, and criteria for achieving professional competencies in the field of programming for the training area 02.03.03 "Mathematical support and administration of information systems" are established based on the professional standards in the field of programming. A model of the student training process is developed by analyzing the nature of competencies, identifying relevant indicators, and aligning the competencies and content of the studied disciplines with professional standards and labor market demands.

Methodology

To address our research questions, we employed a mixed-methods approach involving both qualitative and quantitative research. We utilized document analysis as a qualitative research method and conducted a survey study as part of our quantitative research.

Analysis of Secondary Data: We conducted an examination of data sourced from the Register of Educational Programs, which is maintained by the Ministry of Science and Higher Education (MSHE) (Register of EP of the MSHE, 2023). This analysis encompassed all the developed programs that are registered in the Register of EP. The Register of EP serves as an accounting and informational tool, facilitating the provision of information to various stakeholders, including staff in higher education institutions, secondary education employees, parents of schoolchildren, and prospective applicants. It provides details about the educational programs being offered by higher education institutions. The inclusion of an educational program in the Register of EP serves as confirmation that it aligns with the qualification requirements for higher education institutions. Our analysis, focusing on programs registered in the EP, allowed us to identify cases where IT industry requirements were incorporated into these educational programs.

Professional Standards Analysis: We conducted an analysis of the IT industry PS included in the (Register of Approved Professional Standards, 2022). Our goal was to identify the knowledge, skills, and abilities necessary for individuals aspiring to pursue careers in the IT industry. In total, 25 PS have been developed and approved for the IT industry, with the second version released in 2022.

Survey Research: In addition to the data-driven methods mentioned earlier, we conducted surveys to collect input from two primary stakeholder groups: business representatives seeking well-trained IT

specialists from higher education institutions and university representatives responsible for IT specialist training.

The survey study aimed to achieve the following objectives:

- Explore the points of view of business representatives and teachers about the degree to which business requirements are reflected in university EPs.
- Investigate potential variations in perspectives based on factors such as the number of employees, experience in the IT field, gender, and job positions.

Methodology of the survey study

Participants: In Kazakhstan, the total number of ICT specialists, based on official statistics, stands at 40,409 individuals, with 15,286 specialists employed in Almaty, as reported in (On the use of information and communication technologies at enterprises of the Republic of Kazakhstan, 2022). Additionally, there are 52,909 students pursuing undergraduate degrees in the field of ICT training as per data on (Distribution of students by specialty, 2022).

To determine the number of university teachers employed across all educational programs in the ICT field, we will use the established ratio of "1 teacher per 16 students" as specified in the qualification requirements for all universities. This calculation results in 3,306 teachers. However, it should be noted that 25% of them are involved in teaching general compulsory disciplines, such as History of Kazakhstan, Philosophy, and others. Consequently, the total number of teachers in ICT disciplines can be estimated at 2,480 individuals. The sample for this study included 134 business representatives, who are either CEOs or employees in IT industries, and 175 faculty members specializing in IT majors. The participants were selected using a convenience sampling technique.

Convenience sampling is a sampling method that researchers use when selecting easily accessible and readily available units due to various constraints or limitations. The choice of convenience sampling method in this study was driven by the research team's practical constraints. It is important to note that the study's findings may not be generalized to the broader population and are intended for use as preliminary insights gained from surveying the two specific participant groups.

If we consider allowing the results to be extended to the general population, then for the sample of business representatives (sample of 134 from a population of 40,409), the margin of error would be approximately 8.45% at a confidence level of 95%. Similarly, for the sample of teachers (a sample of 175 from a population of 2,480), the margin of error would be approximately 7.1% at a confidence level of 95%. Survey participants were selected from lists acquired from various sources, including university and company websites, Internet publications, and social networks such as Instagram, Facebook, and LinkedIn. The participants were chosen to represent different genders, characteristics, and work experiences. It's important to note that participation in the study was entirely voluntary.

The Instruments and Data Collection Process: The study was structured to involve two distinct groups, namely business representatives and faculty members. As a result, two separate instruments in the form of questionnaires were designed to gather their perspectives. These questionnaires were developed by the researchers after a comprehensive review of the literature and consultation with various experts in the field.

The questionnaire, meticulously developed with input from experts, encompasses two main sections: demographic information and the scale assessing the need for IT curriculum change in companies. The demographic section comprises five questions, including inquiries about years of experience and gender. This structured questionnaire aims to gather comprehensive data from participants involved in the business sector.

The Business Representatives' Perspectives Need Scale comprises 14 questions on a 5-point Likert scale (1: Strongly Agree, 5: Strongly Disagree). The scale evaluates the adequacy of IT courses offered in university education for business representatives operating in the IT sector.

The questionnaire for participants serving as faculty members in IT majors comprised two sections: demographic information and the IT curriculum change requirement scale for IT majors. Demographic questions include three aspects: years of experience, gender, and IT field experience. The Perspectives of Faculty Scale consists of 13 questions on a 5-point Likert scale. Within the study's scope, the questionnaires were administered online. Participants received invitations to partake in the questionnaire, and responses were collected through an online platform and subsequently transferred to a Microsoft Excel file. Following the conversion of responses into scale points, the values were inputted into SPSS (version 21) for the analysis process.

Data Analysis: The data collected from business representatives underwent a thorough statistical analysis using SPSS. This analysis aimed to examine potential differences based on participants' experience and gender. Descriptive statistics, encompassing means and standard deviations, were computed for each variable, offering an overview of the data's central tendency and variability.

One-way analysis of variance (ANOVA) tests was conducted to evaluate differences across experience groups for each variable. The null hypothesis assumed no differences among experience groups, with post hoc tests (Tukey's HSD) performed for significant results. Independent t-tests were utilized to investigate gender-based differences for each sub-factor and each questionnaire item. The null hypothesis posited no differences based on demographic features, while the alternative hypothesis anticipated significant distinctions. The results of the ANOVA and t-tests are summarized below.

Results and discussion

Reflection of the requirements of professional standards of the IT industry in the contents of the EP.

Prior to the 2018 reform in the higher education system of Kazakhstan, IT specialists were trained in the following specialties: Informatics, Information Systems (IS), Computer Engineering and Software (CES), and Mathematical and Computer Modeling (MCM). Following the introduction of Educational Programs (EP), training shifted from specialties to EP, which retained names corresponding to the old specialties. Additionally, new surveys emerged, reflecting universities' responses to the new challenges and needs of the labor market.

Table 1 illustrates the key indicators of EP and the criteria employed for training bachelor's level IT specialists. As of July 2023, there are a total of 299 EP registered in the field of education under code 6B06 - ICT, with 201 EP established in 2019 or earlier. Significantly, the majority of these programs (250 out of 299) are concentrated in the 6B061 – ICT technologies category, comprising 175 developed in 2019 and 75 within the period from 2020 to 2023.

We focused on the EP that was developed in 2019 as they were first used for graduating students. EPs created after 2019 have not yet had a substantial influence on the labor market, as their graduates are still pursuing their bachelor's degrees. Programs established prior to 2019 were either removed from the registry or updated to ensure their continued relevance and status. Among the 250 educational programs in the 6B061 - ICT category, a significant portion of them still retain the names of older specialties, including IS, CES, Informatics, and MCM. It's important to mention that the majority of these programs were developed before 2019.

Also, from 2020 to 2023, new specializations have been introduced, often differing in both name and content from the older specialties. Despite the significant number of new programs, no single specialization has emerged as the predominant choice among students.

Table 1

The number of EPs in the field of education is 6B06, entered in the Register for 2019–2023. Compiled by the authors based on data from the Register of EP

Training areas (EP)	Number of EP entered in the register		
	In total	developed in 2019	developed in 2020–2023 years
6B061 - Information and Communication Technologies, including EP IS EP CES EP Informatics EP MCM other EP	250 61 43 24 10 112	175 52 34 19 10 60	75 9 9 5 0 52
6B062-Telecommunications, including EP RET other EP	33 17 16	18 12 6	15 5 10
6B063-Information security including EP Information Security systems EP Cybersecurity other EP	16 4 3 9	8 4 1 3	8 0 2 6
Total	299	201	98

A noticeable trend toward the creation of interdisciplinary programs is evident in the Register. These programs include IT-medic, IT medicine, IT entrepreneurship, digital economy, digital marketing, digital agricultural systems and complexes, digital management and design, agro informatics, IP in industry, business, and education, as well as e-commerce, among others. It's uncertain whether these programs are currently in high demand or if their content effectively addresses contemporary challenges and aligns with employers' needs.

A significant number of new programs in the Register have names that mirror the current trends in the IT industry's development. These programs include Computer Science, Data Science, Software Engineering, DevOps Engineering, Natural Reality Modeling, Artificial Intelligence Technologies, Big Data Analytics, Information Processing, and Data Visualization, among others. Some of these programs may emerge as the top choices for students in the future, and their graduates are likely to be highly sought after by employers, particularly in IT companies.

Among the 33 EP areas registered under 6B062-Telecommunications, 17 programs still retain the previous specialization name, which was Radio Engineering, Electronics, and Telecommunications

(RET). Similarly, within the 6B063-Information Security (ISec) training category, four programs have also retained the name of the specialty as Information Security Systems (ISS).

In general, it can be observed that the process of training personnel for the IT industry is still in a transitional phase, where a new system of training and qualification recognition is being introduced. This significant change is associated with the shift to a new classification system, the abandonment of the concept of "specialty," and the issuance of diplomas without specifying the qualifications of graduates.

Previously, the old tradition continued, with universities themselves confirming the qualifications of graduates. However, beginning with the 2018–2019 reform, the process of qualification verification has shifted from universities to employers. Diplomas now indicate the academic degree "bachelor" along with the name of the EP.

Furthermore, the previously existing state standards of specialties have been abolished. These documents used to include recommended curricula and standard programs for all disciplines, which were also approved by regulatory authorities. Higher education institutions had limited flexibility to make changes. Now, they have the autonomy to determine the content of all disciplines independently, with only a small number of common disciplines being exceptions.

In Table 2, we have chosen to focus on two of the most popular EPs currently available: Information Systems (IS) and Computer Engineering and Software (CES). Our objective was to analyze how the content of these programs is influenced by the requirements outlined in the PS. Specifically, the IS EP was developed by 61 universities, with 24 of them opting not to incorporate the PS. CES EP was developed by 43 universities, with 16 of them choosing not to utilize the PS.

The primary standards incorporated into these EPs are associated with professions that have significant roles in different phases of the software life cycle. This includes standards related to design (such as "Business Analysis in ICT"), development (like "Software Development"), testing (including "Software Testing"), operation (encompassing "Software Maintenance," "Database Administration (DB)," and "System and Network Administration").

Table 2

Use of the PS in the EP IS and CES. Compiled by the authors based on data from the Register of EP

EP	Number of universities that developed EP	Number of EP that used PS	Most popular of the PS used (number of EP)
IS	61	37	Database Administration (12) Software Development (11) Business analysis in ICT (6) Software Testing (5)
CES	43	27	Software Development (20) Software Testing (8) System and Network administration (6) Software maintenance support (5)

Documents and guidelines aimed at promoting collaboration between the higher education system and the labor market delineate the goals, methods, and requirements for PS and EP development. As an example, the National Qualifications Framework of Kazakhstan (2021, p.3), a publication endorsed by the European Foundation for Education, emphasized that "the National Qualifications Framework of Kazakhstan is presently in the process of implementation."

In the section "Goals of the National Qualifications Framework," among other objectives, the following tasks are outlined for the National Qualifications Framework:

- Describe the requirements for qualification learning outcomes from a unified perspective;
- Develop professional standards, educational standards, and educational programs on a unified methodological basis;
- Support the development of evaluation materials.

The Guidelines for the development of educational programs for higher and postgraduate education (2023) establish mandatory requirements for the design of educational programs. Specifically, they emphasize that the training outcomes in the EP should be aligned with labor functions and anticipated labor market demands (paragraph 20). Furthermore, paragraph 31 specifies that "In the EP developed based on the PS, the main labor functions are translated into competencies and learning outcomes."

Nonetheless, despite these explicit instructions, a comprehensive examination of the content of both the EPs listed in the Register and the approved PSs reveals disparities in the methodological approaches employed in their development. This divergence has resulted in a significant disparity between these documents, posing a substantial obstacle to the establishment of a system for verifying the qualifications of undergraduate graduates at the university. Conducting an independent external assessment to validate qualifications, as stipulated in the Law of the Republic of Kazakhstan "On Professional Qualifications," which has not yet come into effect.

Let us consider the reflection of the content of PS in the Learning Outcomes (LO) of programs using the example of two EP: technical and multidisciplinary universities, see Appendix. Both programs indicate that they are focused on the requirements of many PS at once, the technical university indicated eight PS, multidisciplinary – five PS. However, the language of the LO does not provide confirmation of this alignment. In the case of a technical university, there are 14 LOs formulated, and among them, three (LO1, LO2, LO3) are related to outcomes derived from general mandatory disciplines. LO13 pertains to personal competencies and mentions terms like "initiative" and "teamwork," but the rest of the phrasing does not coincide with the ones specified in the PS. It is challenging to determine how personal competencies are developed based on the content provided in

the EP given listed in the Register, and there is no information available regarding this in the summarized content of disciplines.

In the description of the outcomes from LO4 to LO11, the content appears to represent cycles of various disciplines, but these are presented in quite a general form. It is challenging to assert that these LOs comprehensively cover the content of all eight standards at once. For instance, LO9 focuses on the "Design and development of ergonomic User interfaces," presented as a distinct learning outcome, even though it could be part of a broader software development outcome.

Overall, when examining the LOs and the concise descriptions of discipline content within the EP, it is challenging to definitively confirm the alignment with the requirements of all eight PS. The descriptions only appear to reflect some of the requirements from several PS in different disciplines. This observation applies to both specialized and multidisciplinary universities.

LO encoding appears to be specific to individual EPs. While the same notation may be used across different EPs, the content and the number of LOs vary. It's worth noting that in Kazakhstan, the removal of specialty standards has given universities the autonomy to independently determine the names and content of their disciplines. Furthermore, no widely recognized documents that establish standardized content for knowledge areas within the IT industry. Different programs with the same name may have varying content. As a result, it's challenging to establish a precise and unambiguous connection between the content of disciplines in EPs and the requirements outlined in PS for the IT industry. To build a meaningful alignment between PS and EP content, one would typically need to focus on a specific program from a particular university and consider 1-2 relevant PS. This approach allows for a more targeted comparison. Attempting to incorporate the requirements of multiple PS into a single EP appears to be a highly challenging endeavor. Unfortunately, in many cases, the content of EPs listed in the Register adopts a more formal approach, often not adhering to the recommendations outlined in approved regulatory documents. This discrepancy can pose significant challenges in aligning education with industry needs.

Analysis of the content of PS. Deviation from the recommendations of regulatory documents is not limited to the development of EPs alone. It's worth noting that the approved PS themselves can exhibit a similar lack of adherence. Each PS outlines requirements for several professions, specifying the necessary knowledge and skills at levels 4–8 of the IT Industry Qualification Framework (IQF). This non-alignment between regulatory guidelines can further complicate the process of ensuring that education meets industry standards.

Achieving Level 5 requires a bachelor's degree (with no work experience), while Level 6 necessitates a bachelor's degree along with practical work experience. Each professional level encompasses descriptions of labor functions, with varying numbers ranging from 2 to 7.

In the General provisions of the PS, it is stated that "... are intended for the formation of educational programs, including for training personnel at enterprises, for certification of employees and graduates of educational institutions...", as seen in the Register of Approved Professional Standards (2022). Each PS passport outlines the development goal as "A systematic and structured description of labor functions that meet the requirements for knowledge, skills, abilities, and personal competencies of employees."

The requirements for knowledge, skills, and abilities are delineated within the context of each labor function (LF), serving as the primary characteristic of the profession. In contrast, the requirements for personal competencies are provided in a general manner and are not categorized into specific labor functions.

Let's take a closer look at one of the frequently utilized PS profiles: Database Administrator. The job description for the "Database Administration Specialist" at level 5 delineates requirements within seven LF categories for knowledge, skills, and abilities:

- 1) Software installation and configuration.
- 2) Ensuring the functionality of the database.
- 3) Monitoring and managing database backups.
- 4) Ensuring information security of the database.
- 5) Analyzing and configuring the performance of a Database Management System (DBMS).
- 6) Ensuring the smooth operation of the DBMS.
- 7) Managing database development.

This suggests that to excel in this profession, individuals must be ready to fulfill the specified job functions, possess the knowledge, skills, and abilities detailed in the description, and demonstrate the required personal competencies. The primary goal of the EP in training specialists based on the PS is to develop readiness for the execution of the LF. Disciplines should be chosen based on the listed areas of knowledge and required skills. Professional skills are developed through tasks aligned with the LF of the profession. Mastery of these skills occurs through practical work in university laboratories and hands-on experience in the workplace during industrial practice.

Table 3 presents an example of the necessary knowledge, skills, and personal competencies for performing one of the LF. We believe that combining skill requirements without distinguishing them is a methodological error. It is likely more appropriate to delineate the essential skills for executing the LF. These skills, particularly professional skills, should become evident when performing the LF. In summary, to qualify as a "Database Administration Specialist" at level 5, one must be prepared to execute the seven work functions described above. In essence, this is equivalent to possessing seven

competencies or seven professional skills. To achieve this, a graduate with a bachelor's degree must also acquire proficiency in five skills and comprehensive knowledge in the six listed areas of expertise.

Moreover, graduates should have nurtured all the personal competencies as indicated in the table. It's important to note that the phrasing of the personal competency requirements does not coincide with the specifications outlined in the State Compulsory Standard of Higher Education for 2022. The State Compulsory Standard of Higher Education for 2022 is a binding document that prescribes the content of general education subjects, including History of Kazakhstan, Philosophy, state and foreign languages, and others. The state explicitly designates the subjects within the General Education Discipline (GED) cycle that must be incorporated into all EP. These subjects are referenced as:

Table 3

Labor functions of the "Database Administration Specialist" profession; require skills, abilities, and knowledge. Fragment of the PS "Database Administration"

Labor function 1 Software installation and configuration.	Abilities and skills: 1. Planning the installation of system software. 2. Installation and management of hardware and software resources. 3. Installation and configuration of system and application software. 4. Take action when errors occur during software installation and configuration. 5. Use the technical documentation for installing and configuring the software.
	Knowledge: 1. The composition of the hardware and software complex used and the characteristics of its components. 2. Functionality of the installed software, including the operating system. 3. Requirements for the installed software. 4. Mechanisms for managing hardware and software resources. 5. Methods for configuring and configuring system and application software. 6. Principles of information security.
Requirements for personal competencies	Organization, initiative, attentiveness, responsibility, discipline, efficiency, flexibility of thinking, critical analysis, result orientation, high learning ability, teamwork.

- Establish a framework of universal competencies that foster the socio-cultural development of the prospective specialist's personality by shaping their worldview, civic and moral principles.

- Cultivate individuals who are adaptable in the contemporary world, possess critical thinking skills, and prioritize physical self-improvement.

This mismatch serves as an illustrative example of the disparity between the content of the disciplines included in the EP and the requirements outlined in the PS. Presently, there are limited publications dedicated to the exploration of matters concerning the development and evaluation of personal competencies as defined in regulatory documents. In general, the challenge posed by the existence of this gap and potential solutions remains overlooked by researchers.

The provided excerpt in Table 3 highlights that the descriptions of knowledge and skills requirements are presented in a generalized manner, and when examined more closely, they lack measurability. Measurability is a crucial attribute for assessing the extent to which competencies are developed and an individual's readiness to perform labor functions. Hence, in order to perform such an assessment, it becomes essential to break down and, in some instances, elaborate and refine the requirements provided in the PS. We will outline our approach, which is based on standard tasks designed for evaluating acquired professional skills. This assessment should be conducted by experts within the production facilities of enterprises or within a specially equipped laboratory at the university.

We will formulate standard tasks by utilizing the detailed descriptions and content of the work functions within the profession of "Database Administration Specialist" at level 5. These tasks may take the following forms:

- Installation and configuration of software such as Windows OS, MS SQL Server DBMS, MySQL.
- Daily monitoring of database usage (utilizing an existing database with access to usage data).
- Performing a database backup (involving an existing database and storage device).
- Analyzing DBMS performance and collecting statistics.

Next, we will examine the knowledge and skills areas necessary for performing standard tasks (substituted in place of LF names). For LF1, as shown in Table 3, we will specify potential discipline names from the EP Information Systems: Databases, Operating Systems, and Information Security. Our subsequent tasks involve identifying topics that describe the required knowledge and skills, as well as creating assessment tasks to evaluate these knowledge and skills.

As a result, the task system can be divided into two components: standard tasks aligned with labor functions (assessed by experts) and tasks designed to evaluate the knowledge and skills needed to execute these standard tasks. The second set of tasks can be presented in the form of tests or written assignments.

To assess the readiness of undergraduate graduates for their future professions, a significant amount of preparatory work is required. This involves considering the knowledge, skills, and abilities

requirements specified in the PS, as well as the requirements for personal competencies outlined in the same document.

Unfortunately, this presents a current challenge because these requirements lack measurability. A potential solution to this problem is discussed by Bowers & Sabin (2022) and Bowers et al. (2022), where the definition of competencies, originally provided in the IT2017 document, is employed. This definition characterizes competence as a combination of knowledge, skills, and personal qualities that are desirable in the workplace.

The perspectives of business representatives and teachers about the degree to which business requirements are reflected in university EPs. To achieve this, the study conducted a questionnaire with business representatives who recruit graduates from IT majors and faculty members in IT majors who educate the students. The aim was to examine how the effectiveness of the curriculum in IT majors in the context of the business sector. The study involved representatives from companies operating in the field of IT and faculty members in IT majors. The findings of the questionnaire were analyzed both descriptively and statistically for both participant groups.

Let us first consider the perspectives of business representatives. An online questionnaire was conducted with representatives of companies operating in the field of IT. The questionnaire included questions about the participants' demographic features, such as the number of employees in their companies, their experience in the field of IT, gender, collaboration with universities, and job positions. The descriptive presentation of the answers obtained is provided in Table 4.

Table 4

Descriptive statistics of employee number, experience in the IT field, gender, partnership, and work position

		N	%
Number of people work in their company	1–10	46	34,3%
	11–50	20	14,9%
	51–200	22	16,4%
	>200	46	34,3%
Experience in the IT field	<5	46	34,3%
	5–10	32	23,9%
	>10	56	41,8%
Gender	Female	38	28,4%
	Male	96	71,6%
Availability of partnerships or cooperation between the enterprise and universities?	The partnership does not exist	57	42,5%
	The partnership exists, this partnership is useful	46	34,3%
	The partnership exists, but this partnership is useless	31	23,1%
Work position	IT specialist	50	37,3%
	Head	84	62,7%

The analysis showed that the study participants were distributed across enterprises of different sizes. Additionally, the distribution of participants based on their years of experience in the field of IT was relatively even. In terms of gender distribution, a male predominance of 71.6% was observed. When considering the distribution of participants according to their positions in the workplace, it was

determined that 62.7% held managerial positions. While exploring the question of how business requirements are reflected in the content of the EP, we noted that the formal approach predominates. EP developers only formally refer to different PSs, without using their requirements for the ability to perform labor functions. In our opinion, this was a consequence of insufficiently close cooperation between universities and business. This is confirmed by the response of business representatives to the question about cooperation, 57 people (42.5%) answered that there is no cooperation, another 31 people (23.1%) answered that there is cooperation, but it is useless.

As part of the study, participants were presented with 14 additional questions, and they were asked to provide their responses on a 5-point Likert scale. These responses were analyzed descriptively to examine the participants' opinions on the IT curriculum in universities.

Table 5.

Business representatives' responses to questionnaire items

	Strongly agree		Partially agree		Diffic Partially ult to say		Partially disagree		Strongly disagree	
	N	%	N	%	N	%	N	%	N	%
Adequate										
Q1. As employers, we believe university professors are aware of business needs	8	6,0%	23	17,2%	32	23,9%	50	37,3%	21	15,7%
Q2. Universities train IT professionals based on business needs	3	2,2%	28	20,9%	43	32,1%	40	29,9%	20	14,9%
Q3. The content of educational programs of universities is adequate to meet the needs of business	5	3,7%	20	14,9%	40	29,9%	54	40,3%	15	11,2%
Q4. Fields of activity in the IT industry go beyond the content of educational programs of universities	43	32,1%	50	37,3%	26	19,4%	9	6,7%	6	4,5%
Q5. We, employers, when hiring university graduates (bachelors) do not use the content of professional standards of the IT industry	25	18,7%	47	35,1%	33	24,6%	21	15,7%	8	6,0%
Q6. The primary criteria for hiring university graduates include a strong knowledge base and a minimum level of professional experience.	62	46,3%	34	25,4%	19	14,2%	6	4,5%	13	9,7%
Q7. The content of educational programs of universities does not meet the requirements of professional standards of the IT industry	41	30,6%	37	27,6%	34	25,4%	16	11,9%	6	4,5%
Update										
Q8. The content of educational programs of universities should be changed to meet the needs of business	82	61,2%	23	17,2%	14	10,4%	5	3,7%	10	7,5%
Q9. University teachers should improve themselves and their skills to meet the needs of the IT industry	78	58,2%	34	25,4%	8	6,0%	3	2,2%	11	8,2%
Q10. The content of professional standards should be changed to detail the requirements for the level of knowledge and skills of IT specialists	69	51,5%	29	21,6%	21	15,7%	8	6,0%	7	5,2%
Q11. Students must study more, acquire more new knowledge and skills to meet the requirements of professional standards	83	61,9%	19	14,2%	14	10,4%	8	6,0%	10	7,5%

Q12. Educational programs of universities should be updated frequently depending on the changing needs of the business	59	44,0%	43	32,1%	13	9,7%	6	4,5%	13	9,7%
Collaboration										
Q13. Universities should inform business about the content of educational programs	74	55,2%	21	15,7%	23	17,2%	5	3,7%	11	8,2%
Q14. To have adequate curriculum content for business needs, business professionals should be involved in the curriculum development process.	86	64,2%	25	18,7%	9	6,7%	3	2,2%	11	8,2%

The questionnaire was structured into three factors: "adequate," "update," and "collaboration." The items in the "adequate" section aimed to assess whether the current content and curriculum of IT majors are suitable for the needs of businesses. This section included items from 1 to 7, with a revision made to item 5. Scoring in the questionnaire was conducted using the Likert Scale, where a total score of 7 indicates strong agreement regarding the adequacy of the current content and curriculum of IT majors. Conversely, a total score of 35 suggests strong disagreement with the adequacy of the content and curriculum. Items 8 to 12 were designed to investigate whether there is a need to update the current curriculum of IT majors.

In the questionnaire, a total score of 5 reflects strong agreement regarding the need for an update of the content and curriculum, while a total score of 25 indicates strong disagreement with the need for an update. The collaboration section of the questionnaire contains the final two items, which aim to gauge the participants' willingness to collaborate with universities regarding IT. The scoring system for the collaboration section indicates that a total score of 2 reflects strong agreement on collaboration with universities, while a total score of 10 indicates strong disagreement with collaboration. The following table provides detailed descriptive statistics for these sections.

Table 6

Descriptive statistics of each factor for business representatives

	N	Minimum	Maximum	Mean	Std. Deviation
Adequate	134	11,00	31,00	20,1119	3,37764
Update	134	5,00	25,00	9,3433	5,27600
Collaboration	134	2,00	10,00	3,6567	2,31732
Valid N (listwise)	134				

The results show that the business representatives tend to disagree with the adequacy of the current curriculum in IT majors (mean 20.11). However, they agree that changes are needed in the curriculum for IT majors. They also express a willingness for collaboration between businesses and universities regarding IT.

Most business representatives noted that the contents of PSs are not used when hiring university graduates. 25 people, or 18.7%, strongly agree with this statement, 47 people (35.1%) partially agree, 33 (24.6%) people found it difficult to answer, see Table 5, Q5. This may be a consequence of that

IT companies are not yet familiar with the content of the software, or they are not satisfied with the requirements for professions described in them. In response to question 10, the majority noted that the content of the PSs should be changed in order to detail the requirements for the level of knowledge and skills. 69 people (51.5%) strongly agree with this, 29 (21.6%) partially agree. In addition, the majority of respondents believe that the content of university educational programs does not meet the requirements of the PS. 41 people (30.6%) strongly agree with this statement, 37 (27.6%) partially agree, 34 (25.4%) found it difficult to answer. In our opinion, the responses from business representatives show that the use of IT industry PSs has not become the norm in companies.

The study also explored whether there is a difference in the opinions of participants based on the size of their companies. The ANOVA test results are presented in Table 7.

A statistically significant difference was found between groups in the collaboration section, as indicated by a one-way ANOVA ($F(3,133) = 2.989$, $p = .033$). The effect size suggests a medium effect ($\eta^2 = 0.06$). A Tukey post hoc test showed that businesses with more than 200 employees are statistically significantly more in agreement with collaboration compared to businesses with less than 10 employees ($p = .020$). No statistically significant differences were observed between the other groups and sections.

Table 7

The differences between factor scores based on the participants' company employee size

		N	Mean	Std. Deviation	F	p
Adequate	1–10	46	19,5870	2,99315	,574	,633
	11–50	20	20,3500	3,63137		
	51–200	22	20,2727	3,52112		
	>200	46	20,4565	3,60066		
	Total	134	20,1119	3,37764		
Update	1–10	46	8,3478	3,76662	1,499	,218
	11–50	20	9,8000	5,49258		
	51–200	22	8,5909	4,54249		
	>200	46	10,5000	6,55490		
	Total	134	9,3433	5,27600		
Collaboration	1–10	46	2,8913	1,76671	2,989	,033
	11–50	20	3,7500	2,44680		
	51–200	22	3,8636	2,56896		
	>200	46	4,2826	2,47353		
	Total	134	3,6567	2,31732		

As part of the research, the participants were asked about the availability and usefulness of partnerships or cooperation between their enterprises and universities. Their responses were divided into three categories: no partnership exists, partnership exists and is useful, partnership exists but is useless. The findings are presented in Table 8.

Table 8

ANOVA test based on the availability of partnerships or cooperation between their enterprise and universities

		N	Mean	Std. Deviation	F	p
Adequate	1	57	20,2456	3,68045	,878	,418
	2	46	20,4130	3,78639		
	3	31	19,4194	1,76587		
	Total	134	20,1119	3,37764		
Update	1	57	9,4386	5,19965	1,460	,236
	2	46	10,1087	6,16163		
	3	31	8,0323	3,64677		
	Total	134	9,3433	5,27600		
Collaboration	1	57	4,0702	2,25879	6,939	,001
	2	46	4,0217	2,56029		
	3	31	2,3548	1,47306		
	Total	134	3,6567	2,31732		

A statistically significant difference between groups was observed in the collaboration section, as indicated by a one-way ANOVA ($F(2,133) = 6.939$, $p = .001$). The effect size suggests a medium effect ($\eta^2 = 0.09$). A Tukey post hoc test revealed that businesses without partnerships tend to agree more strongly on the need for collaboration compared to businesses that have partnerships but find them useless, and this difference is statistically significant ($p = .002$).

No statistically significant difference was observed between the groups. Furthermore, the post hoc test demonstrated that businesses that find their partnerships useful in collaboration tend to agree more strongly on the need for collaboration compared to businesses that have partnerships but find them useless, and this difference is statistically significant ($p = .004$). No statistically significant difference was found between the other groups and sections.

The Perspectives of Faculty Members in the Field of IT. To achieve this, a survey was conducted involving 175 faculty members. The descriptive analysis results are presented in the table below, which includes information about the years of working experience, gender, and the amount of time spent working in the IT field by the faculty members participating in the study.

Table 9

Descriptive statistics of faculty members working in the field of IT

		N	%
Year of experience	up to 5 years	26	14,9%
	5–10 years	29	16,6%
	more than 10 years	120	68,6%
Gender	Female	104	59,4%
	Male	71	40,6%
Experience in IT field	no	39	22,4%
	yes, up to 5 years	45	25,9%
	yes, more than 5 years	90	51,7%

In the descriptive analysis of faculty members based on their years of working experience, the largest proportion (68.6%) consisted of employees with 10 or more years of experience. Those with 5-10 years of experience (16.6%) and those with less than five years of experience (14.9%) had lower representation. When examining the distribution by gender, it was found that there were more females (59.4%) than males (40.6%). Regarding the work experience of faculty members in the IT field, more than half of the participants (51.7%) had five or more years of work experience. The rate of participants with up to five years of experience was 25.9%, and the rate of participants with no experience was 22.4%.

Table 10.
Faculty Members Responses to Questionnaire Items

	Strongly agree		Partially agree		Difficult to say		Partially disagree		Strongly disagree	
	N	%	N	%	N	%	N	%	N	%
Adequate										
Q1. We, university professors, are aware of business needs	61	34,9%	60	34,3%	33	18,9%	10	5,7%	11	6,3%
Q2. Our students receive education adequate for business needs	49	28,0%	52	29,7%	45	25,7%	21	12,0%	8	4,6%
Q3. We prepare our students with business needs in mind	55	31,4%	57	32,6%	28	16,0%	24	13,7%	11	6,3%
Q4. The content of our educational programs is adequate to meet the needs of the business	57	32,6%	53	30,3%	30	17,1%	26	14,9%	9	5,1%
Q5. Fields of activity in the IT industry go beyond the content of educational programs of universities	58	33,1%	51	29,1%	32	18,3%	23	13,1%	11	6,3%
Q8. The content of the educational programs of our university meets professional standards	81	46,3%	51	29,1%	17	9,7%	15	8,6%	11	6,3%
Update										
Q6. The content of our educational programs must be modified to meet the needs of the business	66	37,7%	58	33,1%	20	11,4%	18	10,3%	13	7,4%
Q7. University teachers should improve themselves, improve their skills to meet the needs of the IT industry	123	70,3%	29	16,6%	5	2,9%	5	2,9%	13	7,4%
Q9. The content of IT industry professional standards should be changed	49	28,0%	54	30,9%	38	21,7%	22	12,6%	12	6,9%
Q10. Students need to study more to meet the professional standards of the IT industry	101	57,7%	39	22,3%	15	8,6%	8	4,6%	12	6,9%
Collaboration										
Q11. To have adequate curriculum content for business needs, business professionals should be involved in the curriculum development process.	105	60,0%	42	24,0%	8	4,6%	9	5,1%	11	6,3%
Globalization										
Q12. Educational programs of universities should be based on international needs, and not on the needs of local business	65	37,1%	54	30,9%	31	17,7%	12	6,9%	13	7,4%
Q13. Local business is the right place where our graduates can realize their skills	59	33,7%	63	36,0%	26	14,9%	15	8,6%	12	6,9%

Table 11.*Descriptive statistics of each factor for faculty members in IT fields*

	N	Minimum	Maximum	Mean	Std. Deviation
Adequate	175	6,00	30,00	13,4000	5,73355
Update	175	4,00	20,00	7,9714	3,88103
Collaboration	175	1,00	5,00	1,7371	1,16439
Globalization	175	2,00	10,00	5,9771	1,29079
Valid N (listwise)	175				

The results indicate that faculty members gave a mean score of 13.4 for the 'adequate factor,' suggesting that they are close to 'agree' regarding the adequacy of their curriculum. However, the mean score for the need to update the curriculum is also close to 'agree.' Faculty members also agree that there should be collaboration between businesses and universities. On average, they are almost neutral in their perspective on the globalization of IT majors. The statistical analyses conducted for other variables, such as gender and years of experience, did not reveal any significant differences between the groups.

Most teachers of IT disciplines believe that the content of EP is sufficiently adequate to meet business needs. 57 people (32.6%) strongly agree with this statement, 53 (30.3%) partially agree, see Table 10, Q4. However, business representatives do not agree with this. In the answers to question 3, presented in Table 5, only 5 people (3.7%) strongly agree with this, 20 (14.9%) partially agree, 40 people (29.9%) found it difficult to answer. In our opinion, such a sharp difference of opinions on this issue is a consequence of the lack of cooperation in the development of the EP.

But, at the same time, teachers believe that the content of the EP should be changed to meet business needs. 66 people (37.7%) strongly agree with this statement, 58 (33.1%) partially agree, see Table 10, Q6. Just like business representatives, teachers believe that the content of the IT industry PS should be changed. 49 people (28.0%) strongly agree with this, 54 (30.9%) partially agree, 38 (21.7%) found it difficult to answer, see answers to Q9.

The survey results largely confirm the findings of our analysis of documents such as EP of universities and PS in the IT industry. When examining how business requirements are reflected in the content of educational programs, we observed a predominant formal approach. Developers of these programs often refer to various PS without incorporating their requirements for the ability to perform specific job functions. In our opinion, this reflects a consequence of limited collaboration between universities and businesses. We noted above that the majority of business representatives answered that there is no cooperation, or that it exists, but is useless.

We believe that the outcome of limited cooperation is evident in the differing assessments of the alignment between the content EPs and requirements of PSs of the two groups. While business

representatives express concerns about inconsistency (with 41 people or 30.6% strongly agreeing and 37 people or 27.6% partially agreeing, as shown in Table 5, Q7), faculty members tend to see compliance (with 81 people or 46.3% completely agreeing and 51 people or 29.1% partially agreeing, as indicated in Table 10, Q8).

Both business representatives and faculty members from the two groups are in agreement about the importance of cooperation. The primary form of cooperation appears to be the active involvement of business representatives in the development of the EP. A substantial percentage of business representatives (64.2%) completely agree with this approach, while 18.7% partially agree, as indicated in Table 5. Among faculty members, 60% strongly agree with this, and 24% partially agree, as seen in Table 10.

The majority of representatives from both groups agreed that changes are needed in both the PS and the EP. Specifically, they expressed the need for changes in EP to ensure it aligns more closely with business requirements. Additionally, they highlighted the importance of refining the PS to provide more specific and detailed requirements for knowledge and professional skills.

Conclusion

The primary question addressed in this study was the extent to which PS requirements are integrated into the content of university EP. Our analysis of the EPs listed in the Register and the input from stakeholders revealed that, in many cases, developers merely list the names of the software targeted in a formal manner. Upon careful examination, it appears challenging to find evidence of the incorporation of professional requirements in the definition of learning outcomes and disciplinary content. Furthermore, the presence of a substantial number of PSs, ranging from 8 to 10 names, in the EP passport is noted. This approach, while comprehensive, may prove difficult to implement in practice, particularly considering that a single standard may encompass descriptions relevant to multiple professions.

The comparison of the contents of the PS of the IT industry and the EP of universities constitutes the initial stage in devising methods to evaluate students' preparedness for job functions. Our research findings indicate that such comparisons can only be conducted within an individual university. This suggests that the system for assessing professional competencies at a university may vary based on the approaches adopted by different developers. To address this issue, leveraging the experiences of developed countries in formulating BoK for contemporary activities in the IT field could be a viable solution. Achieving consensus among all stakeholders regarding the contents of such bodies of knowledge would facilitate their incorporation into PS and EP disciplines. This approach holds the potential to align the contents of the two documents and promote convergence.

The analysis of the content revealed a significant issue related to the lack of measurability in the majority of the standards' requirements. This highlights the need for additional methodological efforts in the development of tasks that underpin any tool designed to assess the level of qualifications in a given profession. The need for an assessment tool in universities becomes crucial, especially in anticipation of the implementation of an independent qualification recognition system in Kazakhstan. Such a tool would enable students to receive a preliminary assessment of their readiness to fulfill the job functions outlined in the standards.

The future direction of our research involves developing a tool for assessing the level of professional skills and a comprehensive model for conducting assessments at the university level.

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Appendix

Main indicators of the EP "Information Systems" developed by different universities. Compiled by the authors based on information from the Register of EP of MSHE (2023).

The purpose of the EP	The goal is to provide high-quality education for specialists in the field of information systems, encompassing software, hardware, information, legal, and management support for the development and maintenance of information systems.
Specified PS	1. Development of technical documentation 2. Business Analytics and Project Management (old version) 3. Managing the architecture of computer systems 4. Development of big data processing and storage systems 5. Providing software support 6. System analysis in ICT 7. Database Administration 8. Business analysis in ICT
Learning Outcomes	LO 1 - Categorize and synthesize acquired knowledge to describe individual phenomena and events in the context of the broader paradigm of world-historical development of human society and their country. LO 2 - Demonstrate proficiency in written and oral communication in both native and foreign languages, enabling effective professional communication. Ability to construct logical, persuasive oral and written discourse. Willingness to utilize at least one foreign language. LO 3 - Apply foundational knowledge of mathematics, mechanics, physics, and electricity, including key concepts and principles. LO 4 - Develop algorithms to solve problems, create programs using various programming languages at different levels, and design appropriate data structures. Utilize well-known software packages as needed. LO 5 - Construct an information domain model for the design of information systems. LO 6 – Utilize modern Database Management Systems (DBMS) to construct information system databases, represent data using various models, and efficiently manage database objects. LO 7 – Apply computer simulation methods to analyze and interpret various dimensions and structures, enabling the selection of optimal solutions. LO 8 – Select appropriate methods and tools to construct modern ICT security systems. LO 9 - Design and develop an ergonomic user interfaces LO 10 – Create technical projects for the development of information systems for various purposes and with different architectures. LO 11 - Run web layout and create a web application using modern technologies LO 12 - Design the network infrastructure of the IP LO 13 – Make managerial and technical decisions, demonstrate communication skills, initiative, and psychological preparedness to work, including in a team. LO 14 – Develop information systems and their components in various subject areas using modern methods of managing IT projects.

B. Multidisciplinary University

The purpose of the EP	The training of highly qualified, multilingual specialists with critical thinking, prepared for professional activities in the digitalization of various sectors of the economy, and possessing advanced knowledge in the field of IT.
Specified PS	1. Software maintenance 2. Administration of graphics and operating systems 3. Testing Web and multimedia applications (old version) 4. Database Administration 5. Conducting web monitoring
Learning Outcomes	LO 1 – Communicate effectively in the professional environment and society in Kazakh, Russian, and English, while adhering to the principles of academic writing and the culture of academic honesty. LO 2 - Apply knowledge of natural sciences, mathematics, social sciences, socio-economics, and engineering in professional activities. Utilize methods of mathematical data processing for scientific and experimental research, as well as understanding regulatory documents and elements of economic knowledge. LO 3 - Develop, test, implement, and maintain all types of IT project support according to the established standards. LO 4 - Effectively apply the fundamental technologies and principles of blockchain and distributed ledger technologies in practical scenarios. LO 5 - Demonstrate proficiency in programming within various environments, including C# for web service development, Python in the Django framework, Java, and JavaScript for iOS and Android application development. LO 6 - Explain the fundamental principles of information security in information systems, and provide practical recommendations for implementing technical information security measures during the design and implementation of information processes on various devices. LO 7 - Install and maintain graphics and operating systems while ensuring the functionality and information security of databases. LO 8 - Design, create, modify web resources, integrate them with other computer applications, and administer and update web resources. LO 9 - Apply mathematical tools for making and optimizing managerial decisions when solving automatic and automated control tasks. LO 10 - Describe the functioning of the organization's IT infrastructure, the regular operation, and security of the operating system (OS) and database management systems (DBMS). LO 11 - Demonstrate the practical application and configuration of the 1C: Enterprise software product for automating accounting and management accounting of the enterprise. LO 12 - Collect, analyze, and process big data using Big Data and Data Mining technologies. LO 13 - Work effectively both individually and as a team member, demonstrate self-directed learning, self-defense skills, and maintain a healthy lifestyle.