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Assessment of the professional usefulness of engineering studies in the opinions of working students at the Cracow University of Technology

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Abstract. Professional suitability, treated as the efficiency of an employee in a work situation, is subject to continuous development throughout the entire period of professional work of an individual. However, an important role is played by professional preparation carried out throughout the entire process of formal education. The aim of the article is to show the level of professional usefulness of engineering studies in the opinions of the working students of the Cracow University of Technology.

Ocena przydatności zawodowej studiów inżynierskich w opiniach pracujących studentów Politechniki Krakowskiej

Słowa kluczowe: studia inżynierskie, przydatność zawodowa

Streszczenie. Przydatność zawodowa traktowana jako sprawność pracownika w sytuacji pracy ulega ciągłemu rozwojowi przez cały okres pracy zawodowej jednostki. Istotną rolę pełni przygotowanie zawodowe realizowane w procesie edukacji formalnej. Celem artykułu jest pokazanie poziomu przydatności zawodowej studiów inżynierskich w opiniach pracujących studentów Politechniki Krakowskiej.

Introduction

In the contemporary labour market, the significance of professional competencies is increasingly growing. The future of a modern economy is shaped by the continuous growth of employees' competencies. Employer expectations are centred around professional suitability, which is understood as an employee's ability to perform specific tasks. Professional suitability has become a key criterion for employers not only during the recruitment process but also throughout the entire duration of employment. Therefore, embarking on a professional career requires an employee to possess, on one hand, an adequate level of competencies expected by the employer, and on the other hand, an appropriate attitude towards professional tasks, as well as establishing effective relationships within the work group. This concept of work readiness can be understood twofold: as a process and as its outcome. The essence of the process lies in a set of didactic and educational activities aimed at an individual's mastery of a specific profession, ultimately resulting in the attainment of high professional suitability. The outcome, in turn, indicates the education characterized by qualifications essential for a given profession, as well as a set of personal traits that define a professional identity. Consequently, an individual's preparation becomes the primary criterion for verifying their professional suitability, thus forming the fundamental concept and research area within the field of pedagogy of work.

Professional suitability – diversity of approaches

Within the field of pedagogy, various understandings of the scope of professional suitability and its assessment can be found. In the most basic criteria of division, the narrow understanding of professional suitability refers to the demonstrated level of fulfilling professional tasks in a specific job position, rather than the profession itself (Korabiowska-Nowacka, 1980, p. 21). On the other hand, the broad understanding of professional suitability encompasses the vocational and social level of an employee's functioning within an organization (Woroniecki, 1991, p. 80). Additionally, in pedagogical literature, we encounter distinctive approaches to professional suitability from different authors. Zygmunt Wiatrowski (2005, p. 265), drawing on Tadeusz Nowacki (2004, p. 205), defines professional suitability as the proven level of solving work-related tasks. However, he argues that an essential condition for professional suitability is an appropriate

knowledge base supplemented by experience, as well as possessed physical, intellectual, and moral characteristics. Waldemar Furmanek (2000, p. 186-187) formulates professional suitability as the verified level of professional preparation in relation to a specific job position and the tasks and functions associated with it. The assessment of professional usefulness involves evaluating the level of professional preparation of an individual to carry out a range of tasks in a job position. In the pedagogy of work, the most universal definition was proposed by Kazimiera Korabiowska-Nowacka (1980, p. 19-20). She created an operational definition in which professional suitability refers to vocational preparation evaluated in the light of tasks performed in a job position. She also distinguished between suitability for a job position and suitability for a profession. If a school provides a "broad profile" of education, preparing individuals for work in multiple job positions that constitute a profession, then we can speak of suitability for a job position on one hand and suitability for a profession on the other. Suitability for a job position is the relationship between the preparation for that position and the tasks associated with it. Suitability for a profession, on the other hand, expresses the relationship between the overall preparation for individual positions within the profession and the entirety of tasks performed in those positions.

A brief analysis of the presented definitional approaches leads to two conclusions:

1. In discussions regarding professional suitability, it is essential to emphasize the pivotal role of education in vocational preparation, which serves as the initial stage and the primary domain for examining suitability.
2. In contemporary, ever-changing human-work relationships, professional suitability necessitates continuous redefinition. Merely focusing on the assessment of vocational preparation is insufficient; there is a need for perpetual reinterpretation of the multifaceted role of individuals in the context of modern work.

Methodological assumptions of the author's research

All conducted scientific research should adhere to methodological requirements that ensure credibility. One of the fundamental methodological tasks is defining the research problem, which constitutes a significant stage in the preparation for research. Tadeusz Pilch and Teresa Bauman (2001, p. 43) explain that it is a seemingly simple verbal procedure involving the precise

breakdown of the topic into questions that become the problematic questions. Similarly, Mieczysław Łobocki (2006, p. 21) holds the view that the research problem is a question or set of questions to which the planned study should provide answers. The analysis of the literature on the subject and the analysis of the outcomes of graduates from the Krakow University of Technology served as inspiration for determining the main research problem, which was formulated as a question: How do working students at the Krakow University of Technology assess the professional usefulness of the competencies they acquire during their studies at the current stage of their employment?

The diagnostic survey method was employed in the study. This method allows for research to be conducted within specific social groups. The survey involves posing selected closed-ended questions to a chosen group of individuals, which are then subjected to quantitative data analysis. The chosen research method served as a criterion for selecting appropriate research techniques and tools. The primary tool utilized was a custom-designed online survey questionnaire for students using the Microsoft Forms application. The survey was made available to a selected group of students from the Krakow University of Technology, along with a link to access the questionnaire. The questions contained in the survey were developed based on the research problem and aimed to determine the level of usefulness of engineering studies when students enter the professional workforce. Additionally, a brief demographic questionnaire was included at the end.

The research was conducted at the Krakow University of Technology during the academic year 2022/2023, specifically in the months of October to November 2023. A purposive sampling method was adopted due to the availability of participants. The study was carried out among a group of students who had to meet the following criteria: 1) possess the student status at the Krakow University of Technology in the academic year 2022/2023, and 2) confirm at the preliminary stage of the research that they were working professionally as students. In total, 300 students from the Krakow University of Technology participated in the study.

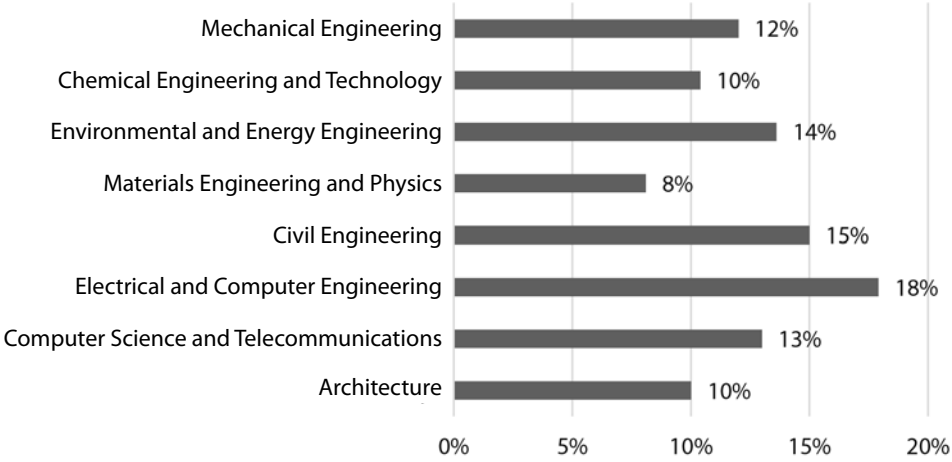

Figure 1. Surveyed students divided by faculties.

Source: Author's own work.

The group of surveyed students represented all eight faculties of the Krakow University of Technology, with the most numerous representation from the Faculty of Electrical and Computer Engineering at 18%, followed by the Faculty of Civil Engineering at 15%, and the Faculty of Environmental Engineering and Energy at 14%. The least numerous group consisted of students from the youngest faculty of the Krakow University of Technology, the Faculty of Materials Engineering and Physics, accounting for 10% of the entire sample.

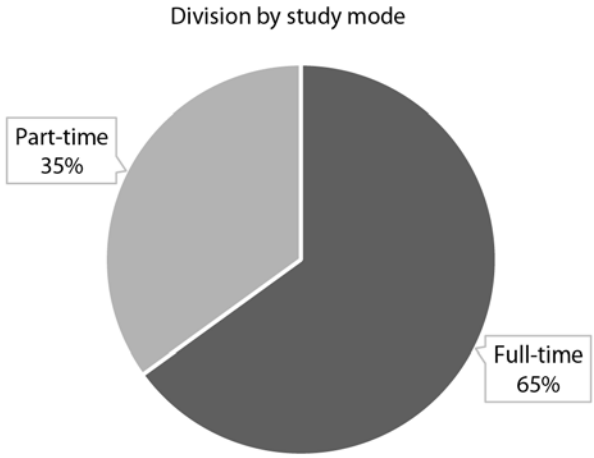

Figure 2. Form of studies of the surveyed students.

Source: Author's own work.

The study included both full-time students (65% of participants) and part-time students (35% of participants). This reflects the natural structure found in universities, where full-time students form the majority group.

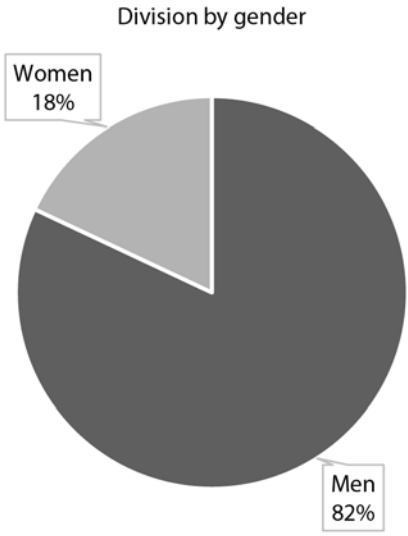

Figure 3. Gender of the surveyed individuals.

Source: Author's own work.

Another characteristic of the participants is their gender. As indicated by the data presented in Figure 3, the vast majority of the surveyed population consisted of males (82%), while females accounted for only 18%. This gender proportion arises from the fact that the Krakow University of Technology is a technical institution where a larger proportion of students are male, and also because in technical professions, more men than women are employed even during their studies.

Professional usefulness of engineering studies in self-assessment of students

In the "Higher Education and Science Act" (Journal of Laws of 2018, item 1668), it is stated that the mission of the higher education and science system is to provide the highest quality education and scientific activity, shape civic attitudes, and contribute to social development and the creation of an innovation-based economy. Therefore, the primary task of every university is to provide education to students at the highest level and prepare graduates for professional work that aligns with the needs of an innovative economy. Research on higher education can address,

on one hand, the intended functions outlined in various legal norms and external and internal documents concerning higher education institutions, and on the other hand, the actual functions or achievements of students, such as their professional outcomes in the workplace. The assessment of professional preparation represents the first stage of examining students' professional suitability, and it serves as a valuable and reliable source of information. In this context, one can pose the question: What is the level of professional usefulness of engineering studies in the professional practice of working students at the Krakow University of Technology?

Factors influencing employment

An essential characteristic of the modern individual is their activity and continuous desire for new experiences. Therefore, young people nowadays often engage in their first professional activities relatively early. The period of higher education is not only a time for learning but also for professional work for many students. This arrangement provides increased financial security, a sense of self-fulfilment, an elevated sense of personal worth, and the opportunity to gain professional experience even during their studies.

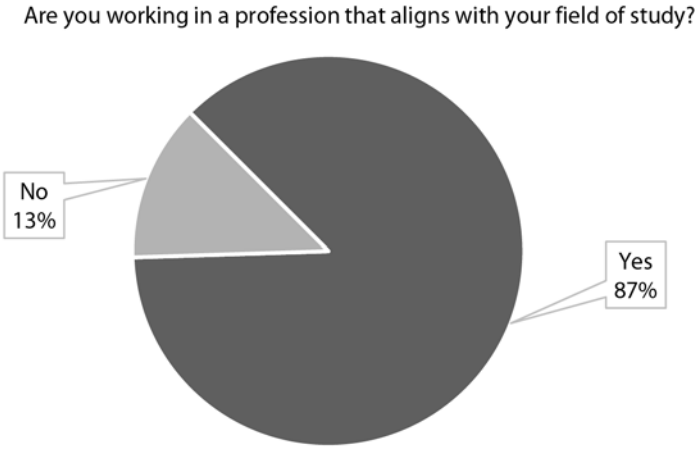

Figure 4. Alignment of work with the field of study.

Source: Author's own work.

Taking into account the alignment of the undertaken work with the type of studies, a significant 87% of the respondents declared employment in the engineering profession related to their studied field, while only 13% were engaged in work unrelated to their current professional preparation. This indicates that engineering studies

increase the chances of finding employment in the desired profession and therefore serve as a response to the demands of the contemporary economy.

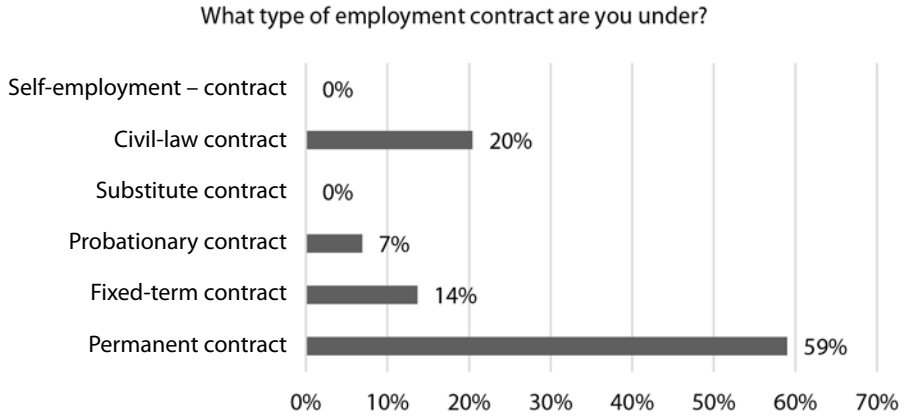

Figure 5. Type of employment contract.

Source: Author's own work.

The surveyed students, nearly 60% of them, reported being employed in the engineering profession related to their studied field under indefinite-term employment contracts. Approximately 20% of students work under civil law contracts. None of the participants reported engaging in their own business activities or collaborating with other entities through self-employment during their studies.

Table 1. Selected determinants of employment

Selected determinants of employment	Decisive	Important, but not decisive
Higher engineering studies, diploma from the Cracow University of Technology	19.2%	80.8%
Professional experience	45.3%	54.7%
Knowledge of foreign languages	46.9%	53.1%
Knowledge of specialized technologies	73.1%	26.9%
Completed specialized courses	19.2%	80.8%
High interpersonal competencies	52.8%	47.2%
Completed professional internships	30.02%	69.8%
Acquaintances, connotations.	16.0%	84.0%

Source: Author's own work.

The decision to take up professional employment is typically influenced by multiple factors. In addition to the recruitment standards prevalent in the job market, many companies and enterprises have their own recruitment policies that precisely define the candidate profile.

In the study conducted among working students, they were asked about the factors that were decisive for their employment and those that were merely important. The study was based on selected employment determinants. Regarding factors marked as 'decisive,' respondents indicated the following: specialized technological knowledge received over 73% of the responses, high interpersonal competencies received nearly 53% of the responses, and foreign language proficiency and professional experience received 46% of the responses. On the other hand, for factors ranked as 'important, but not decisive', engineering studies, a diploma from the Krakow University of Technology (PK), and professional internships received high indications from 80.8% and 69.8% of the respondents, respectively. Specialized courses also received a high rating as 'important' with nearly 81% of the respondents' answers. It is noteworthy that 84% of the students believe that employment is not determined by personal connections or other extrinsic factors. The data from Table 1 allows us to conclude that, according to the surveyed students from the Krakow University of Technology, appropriate professional knowledge and interpersonal skills are decisive factors in securing employment.

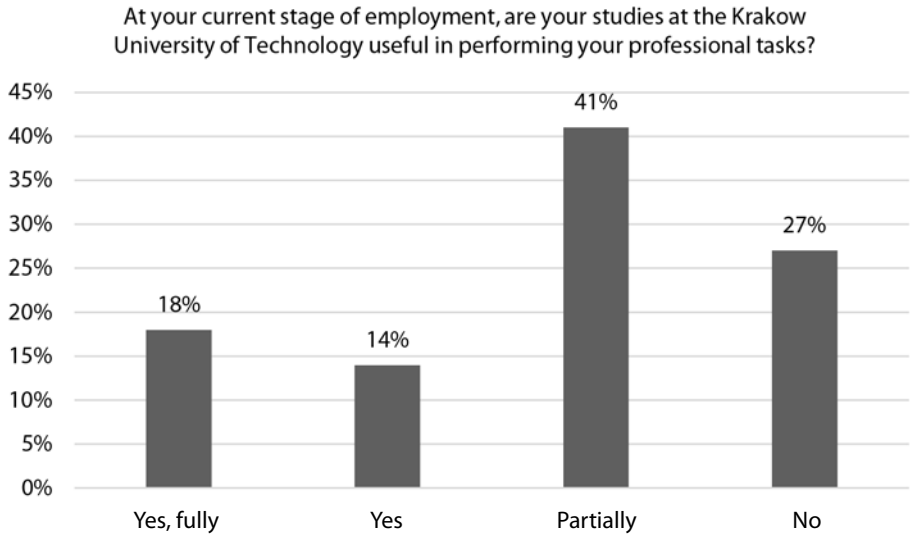

Figure 6. Relevance of competencies acquired during studies in the workplace.

Source: Author's own work.

Thirty-two percent of employed students utilize the competencies acquired during their studies at the Krakow University of Technology, while 41% consider themselves to utilize these competencies only partially. According to 27% of the respondents, these competencies are deemed irrelevant in their current employment. Therefore, the majority of employed students already recognize the usefulness and significance of the knowledge and skills gained during their studies in relation to the tasks performed in their respective job positions at the initial stage of their employment.

Professional internships in the opinion of the respondents

Professional internships are an integral part of vocational education not only in the education system for technical and vocational schools but also in higher education. As mentioned earlier, the "Higher Education and Science Act" obliges universities to conduct practical internships lasting at least six months for first-cycle and uniform master's degree programs, as well as at least three months for second-cycle programs in practical profile studies. For programs with different profiles, universities have the discretion to decide on the inclusion of professional internships. In the case of the Krakow University of Technology, the program and duration of general academic internships are determined by the Faculty Council responsible for the specific field of study. According to the Directive of the Rector of the Krakow University of Technology regarding guidelines for developing first and second-cycle study programs at the Krakow University of Technology (Directive, 2021), the study plans for first-cycle programs include 150 hours of professional internships, equivalent to 5 ECTS credits, with a duration of one month.

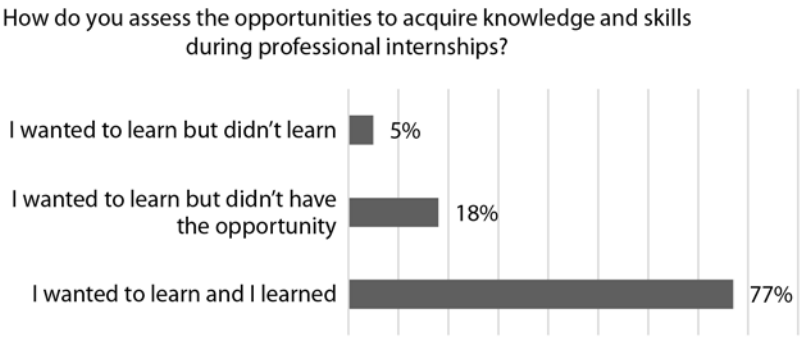

Figure 7. Evaluation of professional internships.

Source: Author's own work.

A significant majority of the respondents, 77%, positively assess their internships, stating that they utilized their internship time to acquire new competencies. However, 23% of them indicate a lack of opportunity to benefit from the internship for their own professional development, despite their readiness and willingness. To improve the effectiveness of professional internships, attention should be focused on adhering to the established internship program, ensuring the full achievement of the intended learning outcomes.

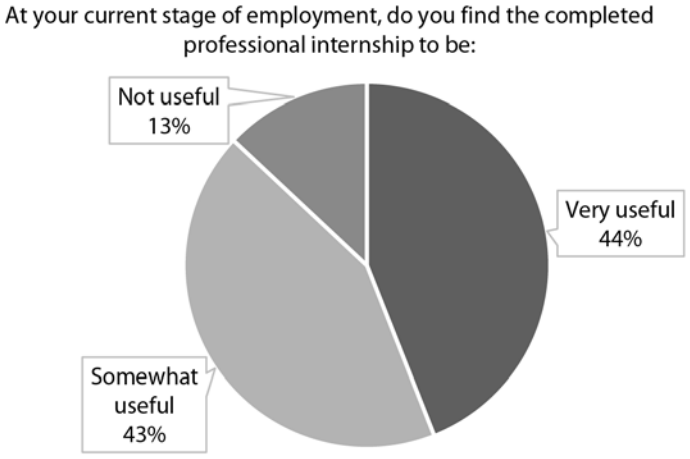

Figure 8. Utility of professional internships.

Source: Author's own work.

During their professional work while studying, 44% of the surveyed students respond that internships are highly useful in carrying out their current professional tasks. Additionally, 43% of them consider internships to be rather useful, while only 13% perceive them as not useful. Professional internships constitute a distinctive element of academic education, emphasizing the development of skills and social competencies, while also providing an opportunity to solidify the theoretical knowledge acquired during studies through practical application in the workplace. Based on the responses of the surveyed students, it can be concluded that internships fulfil their intended purpose for 87% of them.

Evaluation of the engineering education process

One of the fundamental spheres of student activity is the process of studying and acquiring the necessary competencies for professional and social life. How do the surveyed students evaluate the education process?

Table 2. Professional usefulness of basic subject groups.

Basic subject groups	Definitely yes	Rather yes	Hard to tell	Rather yes	Definitely no
Major-specific subjects	14.5%	21.8%	23,6%	18.2%	21.8%
Specialization-specific subjects	21.8%	30.9%	23.6%	10.9%	18.7%
General subjects	5.5%	12.7%	16.4%	23.6%	41.8%
Elective subjects	29.1%	21.8%	21,8%	10.9%	16,4%

Source: Author's own work.

In the study plan of the Cracow University of Technology, four main categories of subjects are included: 1) core (major-specific) subjects, 2) specialization-specific subjects, 3) general subjects, and 4) elective subjects. In the research conducted, students evaluated the professional usefulness of each group of subjects. On one hand, more than 36% of the respondents considered core subjects to be useful, but on the other hand, nearly 40% of them claimed that they were not useful. Undoubtedly, this perception varies depending on the field of study and the current job position. In the case of specialization subjects, almost 53% of the surveyed students expressed their support for their usefulness. General subjects, however, were deemed less useful, with nearly 42% of the respondents expressing their disagreement. Conversely, elective subjects were rated higher than the previous group, as over 50% of the respondents advocated for their professional usefulness. The analysis of the data presented in Table 2 draws attention to the fact that, according to working students' opinions, specialization and elective subjects pursued in their respective fields of study hold importance and practical value in their professional careers.

Table 3. Evaluation of the education process based on selected criteria.

Selected evaluation criteria	Very high	High	Hard to tell	Low	Very low
Usefulness of acquired knowledge	1.8%	23.6%	34.5%	18.2%	21.8%
Principles and methods of education	3.6%	12.7%	27.3%	34.5%	21.8%
Competencies of teachers	5.5%	23.6%	41.8%	21.8%	7.3%
Collaboration between the faculty and the business environment	1.8%	14.3%	57.3%	18.2%	18.2%
Correlation with the needs of the job market	1.8%	20.0%	25.5%	23.6%	29.1%
Opportunity to acquire additional engineering competencies	5.5%	28.8%	36.4%	25.5%	10.9%

Source: Author's own work.

In the conducted study, students also evaluated the education process in their field based on the specified criteria. Regarding the usefulness of the acquired knowledge, the highest indicator, over 34%, was attributed to the response "hard to say," indicating an absence of a clear opinion. Students rated the principles and methods of education poorly, with over 56% of the responses indicating dissatisfaction. The competence of teachers remains inconclusive, as almost 42% of the respondents did not have an opinion on this matter. Likewise, the benefit students derive from their department's collaboration with the business environment was evaluated without a clear trend, as nearly 58% of the respondents were unable to provide a response. The correlation between the education process and the needs of the job market was critically assessed by the respondents, with almost 53% of them rating it as low. The response to the last criterion – the possibility of acquiring additional engineering competencies during the studies – also does not provide a clear picture and does not demonstrate the opportunities offered to PK students. To summarize the analysis of the data presented in Table 3, it can be concluded that the education process at PK requires verification in terms of its principles and methods, the competence of teachers, and an increase in collaboration between departments and the business environment, as well as labour market institutions.

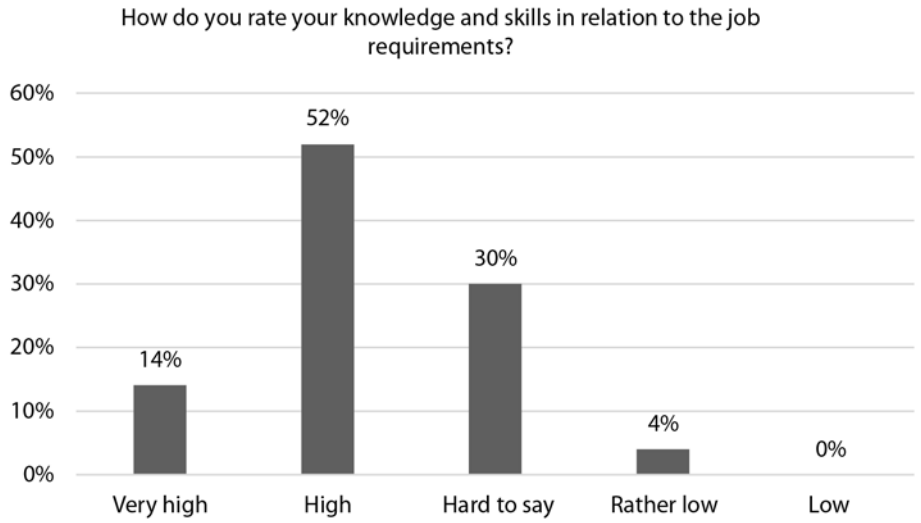

Figure 9. Self-assessment of competencies.

Source: Author's own work.

However, considering all their resources in light of job requirements, respondents rated their competencies as high in 66% of cases. A lack of opinion on this matter was confirmed by 30% of them. It is worth noting that none of the respondents rated their knowledge and skills as low, which is evidence that the surveyed students are aware of their potential and the level of professional preparation they acquire not only from the Cracow University of Technology.

Conclusions

One of the challenges facing higher education is the adequacy of graduates' professional preparation in relation to the constantly changing realities of the job market. Such diagnoses should be conducted by universities in relation to their fields of study. The analysis of the conducted research leads to the following conclusions:

1. In the curriculum of all fields of study, students should be provided with opportunities to acquire a broader range of professional, self-organizational, and social competencies. According to over 72% of the respondents, these competencies are crucial for employment.
2. Greater emphasis should be placed on student internships by verifying their duration and program content. This is because 83% of the respondents

confirm the usefulness of internships in carrying out current professional tasks.

3. The content of core and general subjects should also be reviewed to increase their usefulness for graduates in performing professional tasks. Almost 50% of the respondents indicate the low usefulness of core subjects, and over 40% express the same sentiment regarding general subjects.
4. The level and scope of collaboration between individual departments and industry-specific companies in relation to the field of study also require reflection. This is because almost 60% of the surveyed students do not experience any contact with the business environment and the job market during their studies.

The presented conclusions should be used to modify the study plans at the respective faculties of the Cracow University of Technology. They can also serve as inspiration for other academic institutions when analysing the relevance of education to the current job market demands for engineers.

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