



# A Study on Student Perception of Top 15 Skills Needed in Industrial Revolution 4.0

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**Abstract.** This study aims to identify on student perception of top 15 skills needed in industrial revolution 4.0. This research was survey research using cross-sectional design. The sample was the student of faculty engineering, amounting to 210 students. The sample were established using purposive sampling. The data collection used instrument through questionnaire sheet. The data analysis used the descriptive statistic. This results study identified the top 15 skills as perceived the most important by student's: responsibility and accountability; collaboration; adaptability; professional ethics; technical and literate communication; complex problem solving; self-awareness; creativity, innovation, practical ingenuity; critical and logical thinking; understanding of diversity; teamwork; application and use of technological skills; entrepreneurship; emotional intelligence; and intercultural skills.

**Keywords:** Industrial revolution 4.0 · Student skills · Student perception

## 1 Introduction

Indonesia is predicted to experience a demographic bonus in 2045. The demographic bonus is a condition in which the number of productive age population is greater than the number of population of non-productive age. In that period, it is estimated that the number of productive age will reach its peak, which is 64% of the total population of Indonesia or as many as 297 million people [1]. This population of productive age is an advantage for Indonesia if it can be well prepared and otherwise would be disastrous if neglected.

The large number of productive age population in Indonesia is directly proportional to the challenges it faces. One of the challenges comes from the existence of the Industrial Revolution Era 4.0 (IRE 4.0), which is a revolution that integrates machines with machines that rely on cyber-physical systems. IRE 4.0 is a challenge because it has brought big changes to human life, work and communication. Machines and information technology will slowly replace jobs that use human labour. Thus, it is estimated that existing jobs will be lost in the next 10 years [2]. This condition is dangerous for Indonesia's large population of productive age. Productive age population who do not have the skills relevant to the IRE 4.0 are threatened with not getting a job.

Currently, many of Indonesian productive age population are still unemployed. The population of productive age is 15 to 64 years old aged whom the labour mostly fills. The labour is the population over 15 years of age who are employed, have jobs but are temporarily unemployed, or are unemployed. Unemployment in Indonesia in February 2020 reached 6.88 million, which is an increase of 0.06 million people compared to 2019. The open unemployment rate of higher education contributed 5.73% of unemployment in Indonesia. This situation is possible because higher education has not equipped its graduates with various skills relevant to IRE 4.0, namely life and career skills, skills in learning and innovation, and skills in utilizing information, media, and technology [2].

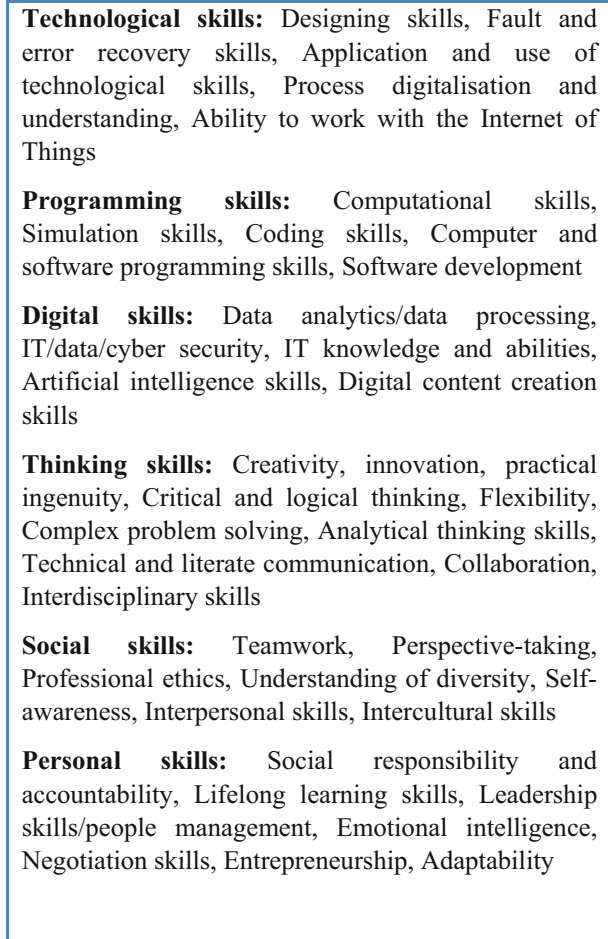
Employability skills are kinds of knowledge, skills, and attitudes as well as other attributes that are relevant in the workplace [3]. These skills consist of two skill categories, namely hard skills and soft skills [4]. Hard skills are technical abilities and knowledge that a person has through training and education, or learned in the workplace specifically for each work situation [5]. These skills are used as the basis for the development of educational curricula, the profile of future jobs and the technical functions most desired by industry [6]. Meanwhile, soft skills, which are non-technical abilities, have a very important role in applying skills and technical knowledge in the workplace. This is because soft skills are related to human issues, such as communication, teamwork, leadership, conflict management, negotiation, professionalism, and ethics [7]. However, the lecturers' efforts in cultivating these various skills to their students encountered obstacles. One of the obstacles is determining which skills should be given priority to students. This is because there are so many job skills, so that an educator is required to be able to develop work skills that are appropriate to what is needed by the industry. In addition, job skills that are the top priority to be given are of course work skills that students have not mastered these skills. Therefore, a higher education lecturer needs to first identify which skills should be cultivated in students.

The purpose of this study was to determine the student perception of top 15 skills needed in industrial revolution 4.0 so that lecturers can promote these skills in their learning to improve the employability of graduating faculty engineering.

## 2 Method and Procedure

This study is a survey research using cross-sectional design. A research design that collects data at one time to the research sample [8]. The population in this study were students of the engineering faculty which consisted of five departments, The Family Welfare Education Department, Mechanical Engineering Department, Civil Engineering Department, Electrical Engineering Department, and Chemical Egeineering Department. The sample in this study amounted to 210 students consisting of male 33.81% and female 66.19%. Determination of the sample using purposive sampling technique in which the researcher determines the sample based on special characteristics in accordance with the research objectives. Students who are sampled in this study are those who have taken industrial practice, so that they are believed to have understood the skills needed in the industrial revolution 4.0 era.

Instruments for collecting data using questionnaire sheets. The questionnaire consisted of 37 items related to the employability skills needed in the Industrial Revolution



**Fig. 1.** Employability Skills Requirements [9]

Era 4.0. Skills requirements in this study refer to the results of research conducted by Maisiri, Darwish and van Dyk (2019) entitled “An Investigation of Industry 4.0 Skills Requirements” as shown in Fig. 1. The categories of skills studied in this study consisted of technical skills and non-technical skills/soft skills. Technical skills consist of three skills sub-category, namely technological skills, programming skills, and digital skills. Furthermore, non-technical skills/soft skills consist of thinking skills, social skills, and personal skills. The scale used is 1 (very unimportant) until 6 (very important).

The data were analyzed using descriptive statistical analysis. This technique is used to calculate the mean and describe the variance score. Descriptive statistical analysis is also used to calculate the ranking of skills from responses.

By the 37 skills, the respondents were then asked to provide an assessment score for each of these skills. Then the results of the respondent’s assessment, the various skills

are ranked based on the highest percentage of respondents who rated these skills as very important. After the skills are sorted, then the top 15 skills are taken.

### 3 Results and Discussion

Based on the survey results, it indicates that social responsibility and accountability are the top skills that are considered the most important for students in the era of the Industrial Revolution Era 4.0. There are 198 respondents (94.28%), who think that social responsibility and accountability is important or very important. The next top four skills are Collaboration (including machine-human), Adaptability, Professional ethics, and Technical and literate communication. Each of these skills is considered very important with a percentage above 74%. Application and use of technological skills are the only technical skills that are included in the top 15 skills ranking most needed in the Industrial Revolution Era 4.0. There are 133 respondents (63.3%), who think that the application and use of technological skills are very important. The frequency of each response and the percentages that indicated the level of importance of top 15 skills needed in industrial revolution era 4.0 as perceived by students can be seen in Table 1.

The mean score and standard deviation of each of the employability skill related to its perceived level of importance is shown in Table 2. Each of the employability skill had a mean score of  $\geq 4.59$  based on a 6.0 scale, where 6 = very important, 5 = important, 4 = slightly important, 3 = slightly unimportant, 2 = unimportant, and 1 = very unimportant. Based on the responses, it shows that there are no skills that are considered very insignificant.

The results of this study indicate that soft skills are the most dominating skills in the top 15 skills rankings. 14 of the 15 skills are soft skills. Based on this fact, it is the reason why soft skills are very important in the educational process. This is because soft skills have a very important role for higher education graduates to be able to increase their work performance optimally and be able to handle the demands and challenges of the dynamic global work world in the IRE 4.0. Soft skills are an important part of student competence to be successful in life, because they are related to work performance and career development, how to manage their interactions and emotions so that they can interact effectively at work [10]. Then, Bringula, Balcoba & Basa said that there is a need to enhance the quality of soft skills for future employees who enter the local workforce and soft skills are perceived by students and employers as relevant employability skills. Soft skills are traits of character, attitude, and behavior - not talent or technical knowledge [11]. Soft skills are specific intangible, non-technical, and personality skills that determine a person's strength as a leader, facilitator, mediator, and negotiator. Soft skills are character traits that enhance a person's interactions, job performance, and career prospects [12].

Furthermore, the results of this study indicate that the top 5 skills consist of social responsibility and accountability, collaboration, adaptability, professional ethics, and technical and literate communication. Based on the results of data analysis, students stated that social responsibility and accountability were the top of soft skills nowadays needed. According to Robles, responsibility is the attitude of someone who shows accountable, reliable, gets the job done, resourceful, self-disciplined, wants to do well,

conscientious, common sense [13]. This means that when someone has the responsibility to do something, but he does not do it or he finds that his work does not match up, he will have consequences. In the world of work, responsibility helps someone to commit to his/her work and complete it as expected. Meanwhile, accountability refers to a situation in which a person can be held accountable. When you are held accountable, you are required to be accountable. With accountability, you have an inner drive to complete these responsibilities. Usually, people who do not have accountability will blame other people or parties if something goes wrong on a job or project for which they are responsible.

Collaboration has distinct advantages for someone because it allows for an effective division of labor; the incorporation of information from multiple sources of knowledge, perspectives, and experiences; and enhanced creativity and quality of solutions stimulated by ideas of other group members [14]. Similarly, Lai stated that collaboration contains inherent flexibility of roles and responsibilities with regards to the various sub-tasks in achieving a goal [15]. On the other hand, collaboration brings two or more experts from different domains together with a common purpose and goals to achieve what neither could on their own [16]. Therefore, responsibility and collaboration have an attachment between each other. Someone who has good collaboration skills will also have good social responsibility. This is because everyone in completing tasks for which they are responsible needs to collaborate with other people to get optimal work results. This approach assumes that the task itself has encouraged collaborative processes to be enacted, and that the task is sufficiently complex that collaboration is required for its successful completion [17].

The next skills needed by students in the era of the industrial revolution 4.0 are adaptability and professional ethics. These skills are important for students to be able to compete in the world of work. As Brian McGowan said that the characteristics of adaptability are needed to encourage every employee to think creatively and innovatively [18]. Companies that have many employees with adaptable attitudes will also hone their ability to become great leaders in the future. Not only that, they have also thought about future leadership strategies that will bring milestones for the company's success. So, adaptability skills are needed for graduates because they reflect the flexibility attitude of a person who has the will to change for the better.

The 4th top skills is professional ethics. The importance of professional ethics is related to the protection of professionals and clients, since it clarifies the responsibilities of the professional and improves their profile [19]. It shows that professional ethics is a morally based standard of behaviour, used to distinguish right or wrong behaviour in all situations. It can also be defined as a set of rules and principles that encompasses responsibilities among professionals, whether as colleagues, clients or society in general [20]. The ethical professional makes choices through the consequences of alternative actions, so the general guidelines of ethics can explain and lead to an understanding of their behaviour [21].

Further, technical and literate communication. Based on the result study by Shopova shows that improving digital literacy of students and their skills in using Information and Communication Technology (ICT) is an important condition for the successful performance and achieving better results in the learning process [22]. Acquiring required

**Table 1.** Perceived Level of Importance of Each Employability Skill in IRE 4.0

Employability Set Skills	1		2		3		4		5		6	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Social responsibility and accountability					7	3.3	5	2.4	17	8.1	181	86.2
Collaboration					4	1.9	4	1.9	38	18.1	164	78.1
Adaptability			1	0.5	6	2.9	4	1.9	40	19.0	159	75.7
Professional ethics			1	0.5	7	3.3	5	2.4	39	18.6	158	75.2
Technical and literate communication			1	0.5	3	1.4	8	3.8	42	20.0	156	74.3
Complex problem solving, trouble-shooting			1	0.5	3	1.4	6	2.9	46	21.9	154	73.3
Self-awareness, self-organisation			3	1.4	7	3.3	5	2.4	42	20.0	153	72.9
Creativity, innovation, practical ingenuity					4	1.9	6	2.9	53	25.2	147	70.0
Critical and logical thinking					4	1.9	4	1.9	56	26.7	146	69.5
Understanding of diversity			2	1.0	6	2.9	5	2.4	55	26.2	142	67.6
Teamwork					9	4.3	4	1.9	58	27.6	139	66.2
Application and use of technological skills			1	0.5	3	1.4	14	6.7	59	28.1	133	63.3
Entrepreneurship			2	1.0	5	2.4	9	4.3	62	29.5	132	62.9
Emotional intelligence			1	0.5	7	3.3	10	4.8	72	34.3	120	57.1
Intercultural skills			1	0.5	7	3.3	13	6.2	70	33.3	118	56.2

digital literacy competencies is a prerequisite for expanding access to information and communication technologies in order to ensure greater competitiveness of young people on the labour market. The other side, ICT literacy has become recognised as the critical literacy for the 21st century that is used to describe various sets of ICT-related capacities [23]. While, Henricksen highlighted the importance of acquisition of competences in relation to communication in the virtual space, the skills needed to search for information and management, to participate in different networks, etc. [24].

Based on the results of this study, it shows that soft skills have become the main element needed by employers, and higher education graduates should consider this to start any career. The demand for the realization of the importance of soft skills is increasing [7], and must be viewed as an investment [13]. Soft skills have a key role in determining the qualifications needed by the industrial world. This is because graduates are required not only to be proficient academically but also to be successful in the element of soft

**Table 2.** Mean and Standard Deviation of Each Employability Skill in IRE 4.0

Employability Set Skills	M	SD
Adaptability	5.52	0.73
Professional ethics	5.28	0.84
Social responsibility and accountability	5.27	0.85
Entrepreneurship	5.20	0.99
Technical and literate communication	5.18	0.86
Teamwork	5.12	0.97
Critical and logical thinking	4.94	1.07
Application and use of technological skills	4.93	1.11
Self-awareness, self-organisation	4.88	0.91
Complex problem solving, trouble-shooting	4.87	0.88
Intercultural skills	4.84	1.05
Emotional intelligence	4.82	1.02
Understanding of diversity	4.80	1.11
Collaboration (including machine-human)	4.71	0.93
Creativity, innovation, practical ingenuity	4.59	1.05

skills in order to compete in the world of work [25]. Therefore, lecturers are responsible for cultivating these various skills to their students. Soft skills can be taught using an integrated/integrated approach [26], developed throughout the professional career of students, the process includes mentoring, training, integration into the curriculum, and practical exposure to the work environment [27]. This is in line with the statement of Omar et al. that institutions must integrate soft skills into the curriculum if students are to develop appropriate work skills [4].

## 4 Conclusions

Students' perceptions about the skills they need most in the era of the IRE 4.0 are dominated by soft skills. 14 of the 15 employability skills that students need are in the form of soft skills, namely social responsibility and accountability, Collaboration, Adaptability Professional ethics Technical and literate communication Complex problem solving, trouble-shooting Self-awareness, self-organisation Creativity, innovation, practical ingenuity Critical and logical thinking Understanding of diversity Teamwork Entrepreneurship Emotional Intelligence Intercultural skills. Then, 1 hard skills needed by students in the form of application and use of technological skills. So that lecturers are expected to be able to promote these skills in their learning to improve the employability of their graduate. Soft skills can be taught using an integrated/integrated approach into the curriculum or into learning methods when carrying out the learning process in the classroom.

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