

Formation of Human Capital in the Digital era: Gender Specifics

Lucia Kohnová and Ján Papula

Comenius University in Bratislava, Slovakia

Lucia.kohnova@fm.uniba.sk

Jan.papula@fm.uniba.sk

Abstract: Under the influence of the Fourth Industrial Revolution, the skills need of current and future employees are also changing. In an environment where people work with machines and digital technologies, it is essential to develop the organization's new skills and competencies in order to remain competitive. Terms such as eskills, digital skills, or technological skills are often used in the context of human capital formation, and become an important part of it for organizations in the digital technology environment. The European Commission, which evaluates the DESI index every year, includes a human capital dimension, where according to the digital skills ranking, many European countries do not even reach 50 points out of 100. From the perspective of companies, jobs require a certain type of technical and digital skills. Gender research points to a significant gap between men and women in the field of IT, as well as in the current level of skills. However, the theory lacks more insight into gender specifics in a generation that will only come to the labour market in the coming period. In our original research, we decided to examine a selected generation Z, young people who are in their final years of high school and are considering the future direction of their education and potential career. This generation, unlike the previous ones, is specific in that it has grown up in many new technologies and encountered them in recent years. The aim of the research was therefore to examine gender differences in generation Z in terms of the perception of different types of skills as an important part of the human capital formation for future. And further take a deeper look at their behaviour in terms of education and career decision-making impulses. The research was conducted on 755 students in Slovakia and Czech Republic and pointed to a significant difference in the perception of the importance of technological and ICT skills between men and women, as well as their external influence on decision-making. The results of the unique research provide basis for the possibilities of setting up education and development of young women in the topic of digital skills, through which it would be possible to reduce this significant gap between men and women in the researched area.

Keywords: human capital, digital skills, technology, gender gap, Generation Z, future work

1. Introduction

Human capital represents the value of human competencies, a combination of different skills, abilities, knowledge or talents of an individual (Martinidis et al. 2021). Human capital is an important part of the intellectual capital of the organization, which forms the cornerstone for building the organization's competitiveness, and which the organization is constantly trying to improve. In the era of digitization, human capital competences are taking on new dimensions, in the form of new jobs and thus new qualifications, the need for digital and technical skills, and a new form of education and expertise (Grigorescu et al. 2021). Some authors even call for a new framework of digital human capital that could represent a vision of digital inclusion and new approach to digital training (Bach et al. 2013).

Under the influence of the fourth industrial revolution, the topic of the new set of skills does not only concern industrial companies (for example in the context of robotics) but also the service sectors. All companies are gradually undergoing transformations and are exposed to great challenges. Industry 4.0 brings new technologies that will redefine many jobs (Németh et al. 2021) by creating new environment of human-machine cooperation. Further as previous industrial revolutions, the current will also lead to destruction of some jobs and creation of other, new ones (Kohnová, Salajová 2019). According to Jansen (2019) competitiveness of businesses in this new era will be highly dependent on technology employed, know-how of employees, individual competences and organizational processes. Thus we can observe, that one of the new strategic priorities of companies and nations is to fully leverage the opportunities that come with digitalization.

Within the Digital Agenda, the European Commission (2021) presented in 2021 a vision and ways to digitally transform Europe, which includes promoting ICT specialization, achieving a high level of digital skills in the population and achieving gender equality in digital skills. Although the topic of new and digital skills is already part of the debate, the gender gap is not narrowing significantly, and it is a problem that needs attention.

Gender research has shown that women are less interested in STEM careers (Wang, Degol 2017). Further, PwC report (2017) on UK respondents reports that only 3% of young women perceive the technical field as a first career choice. Overall, according to their results, it is significantly more difficult for UK employers to recruit

people with digital skills compared to the US or China for example. In terms of technological occupation or STEM, many women perceive a lack of female role models, at least when comparing to men. The importance of developing technological and digital skills among women and reducing the gender gap has several important meanings. On the one hand, in the current state women lose possible opportunities in a variety of careers and work positions, on the other hand, it is also a significant disadvantage for employers regarding diversity in teams, and the use of other diverse human capital that women poses. However, it is not just a matter of STEM career orientation, in the context of the forthcoming industrial revolution and digitization as the technological driver of this era, these digital skills are becoming a necessity for employees in many industries, not specifically technical. González-Pérez and Ramírez-Montoya (2022) in their recent study point to the lack of research in the field of ICT in education and building and strengthening ICT infrastructure for creation of skills for future. In line with the authors, we perceive the importance to get deeper understanding on new challenges regarding ICT and digitalization for future skills, focusing on the formation of human capital. To close the existing gap in literature we have analysed the issue of new and digital skills among young adults from Generation Z, that are in the process of gaining knowledge and skills for future jobs and careers.

2. Literature review

2.1 Future of skills

The topic of a changing environment in terms of the necessary knowledge and skills for the labour market has long been the subject of research. Gradual technological development was also observable in previous periods and gradually caused a changing system of work in various industries, as well as expanded the intensity of services and knowledge-intensive jobs (Barany and Siegel, 2017). The change in the required skills and knowledge of employees is influenced not only by the technological factor alone, but also by a combination of other influences such as population aging (observable in many advanced economies), increasing share of educated population (share of university and vocationally educated population), close links in supply chains and technological push, climate issues and sustainability or managerial trends and changes in work organization such as the introduction of agile approaches and self-managed teams. Either way, these are not individual skills that will be required in the future, but a combination of them. Many authors consider social skills very important in the 21st Century (Deming, 2015). In a study by Bakhshi et al. (2017) authors found that in addition to social skills, cognitive competencies and learning strategies as: System skills -Judgment and Decision-making, Systems Analysis and Systems Evaluation will be important for the US and UK market.

New skills needed for future work are often inflected in the literature as 21 century skills, which include communication, critical thinking, creativity, collaboration, problem-solving and technological competencies. (Schwab, 2016)

Further, according to Deloitte report, the future of work will require a fusion of four types of skills:

- Digital skills and technological skills
- Analytical skills, work with data
- Business management skills
- Creativity, and design skills

However, the digital skill itself represents a diverse set of competencies. According to EU DigComp 2.1 (framework for digital skills), these skills cover 5 areas, in which there are a total of 21 necessary competencies. These areas are digital information and data literacy; communication and collaboration; digital content creation; safety; and problem solving (Carretero et al. 2017).

While several of the aforementioned skills for the future has been acknowledged in the literature, there still exists a significant gap between genders, regarding mainly technology and digital skills. These disparities have a significant impact on opportunities and possibilities of future employment and development for lagging groups. (OECD, 2016, Martínez-Cantos, 2017, Helsper and Eynon, 2013). In this context, however, the authors distinguish between the actual level of skills and abilities, measured, for example, through work performance or testing and self-assessment. According to several studies, women tend to underestimate their self-esteeming skills compared to men, although their real skills may be at the same level (Van Deursen and Van Dijk, 2015). One of the larger studies on this topic was the Martínez-Cantos research (2017), where based on the Digital Agenda

Scoreboard 2012, the author analyzed data from the European Commission. The results of the research, according to other authors, showed the significance of differences between women and men, even in the group of younger and more educated people (Praseytyo et al. 2020). Presenting lower level of digital skills among the group of women compared to men.

2.2 Generation Z specifics

Generation Z represents a group of young people who were born after 1995 until approximately 2010, when the Alpha generation follows (Jha 2020). According to Ryder (1965), the specifics of a generation can be understood mainly in the context of historical events or the specifics of a given time. Generation Z grew up in technology, and the internet and social media are an essential part of their lives. According to Nagy and Kölcsey (2017), they differ from previous generations mainly in the way information is obtained and processed (often multitasking). This generation was often referred to as “digital natives”, “facebook-generation”, “Ebay-babies”, “information curators” or “iGeneration” (Tari 2011, Mohr 2017). Perception of the specifics of individual generations has long been an important topic for employers as well as for the education system.

According to Mohr et al. (2017) Generation Z students often feel overwhelmed and therefore appreciate guidance, for example regarding competencies that are expected in their future careers. Seemiller and Grace (2016) also mention the important role of social media, especially Youtube in the process of acquiring knowledge and learning, beyond compulsory courses and subjects at school. Although we can generally assume that Generation Z is more digital literate than previous generations, their level of digital and technological skills is often dependent on other factors, such as the socio-economic level in which they find themselves, as well as the type and form of education in given institutions (Linne, 2014). The authors' opinions on the specifics of the Z generation tend to differ, especially in a critical view. Some authors highlight negative characteristics such as no sense of commitment, superficiality (Bencsik & Machova, 2016), anxiousness's, disappointment (Tari 2011) and others highlight their motivation to become a driver of change, desire to learn (Mohr 2017) being determined, open-minded, responsible (Seemiler, Grace 2016). Nevertheless, each new generation has always brought change to a society that has not been one-sided and has not worsened. On the contrary, it was possible to draw from the new generation and use its fresh potential.

Given the importance and timeliness of the topic of digital skills and skills for future work as well as the constantly persistent gender gap in the field of technical skills, we consider it very important to examine this issue and look for solutions to reduce this gap. We decided to examine targeted gender differences in the group of young people in Generation Z, who have already grown surrounded by new technologies, but at the same time are just entering the labour market.

3. Research methods

The main goal of the scientific research is to examine gender specifics in the context of human capital formation. We focused primarily on the area of expected skills required for their future careers. Subsequently, in the context of the specifics of the examined generation Z, we analysed in more depth their behaviour in terms of education resource decisions and their decision-making impulses. The research was conducted during 2020 on a sample of 755 high school students from the Czech and Slovak Republics. The respondents were potential applicants for further studies at the university. The research sample consisted of 258 Czech students and 497 Slovak students. In both groups, all regions of the country were covered to ensure the relevance of the research sample. At the same time, within the categorization, the research sample was divided into men and women. In the total sample, 55% were women and 45% were men.

Table 1: Research sample categorizations based on gender and country of origin

	ALL	percentage	SK	percentage	CZ	percentage
ALL	755	100%	497	66%	258	34%
female	416	55%	270	54%	146	57%
male	339	45%	227	46%	112	43%

Source: own processing

The research consisted of main research question: *Which of the following skills do you perceive as key to your future career in 5-10 years?* With possibilities as following: Professional qualifications (expertise); Technological

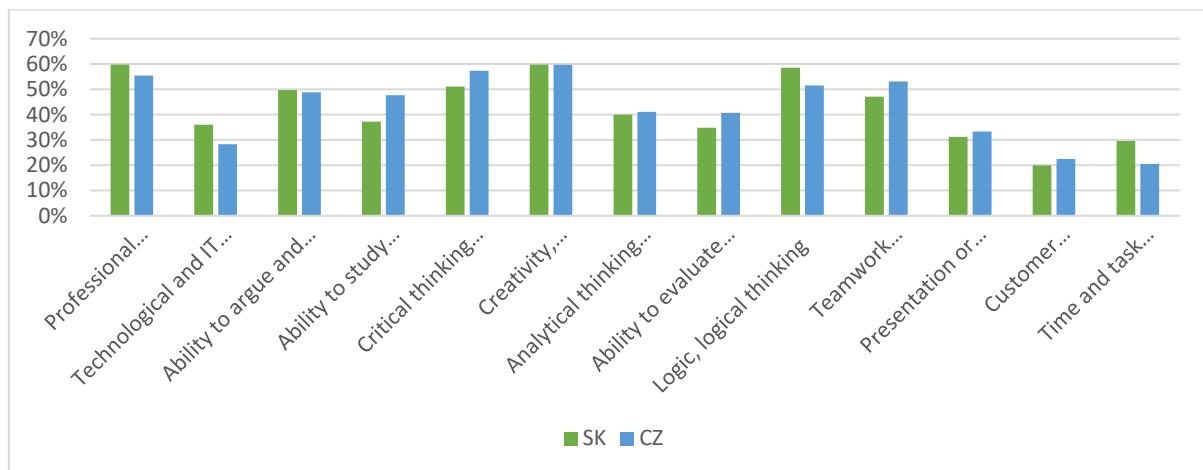
and IT skills, working with specific software; Ability to argue and persuade (assertiveness in communication); Ability to study independently (search and process information); Critical thinking (ability to form one's own opinion based on knowledge and experience); Creativity, innovation and creative thinking; Analytical thinking (capturing, structuring and understanding information); Ability to evaluate the situation (based on a synthesis of several factors); Logic, logical thinking; Teamwork (cooperation); Presentation or communication skills; Customer orientation, ability to understand the customer (empathy, attention, perception of context); Time and task management

Respondents could choose any number of skills. Regarding the decision-making impulses, students were asked: *Who influences you the most when choosing a university and / or future career?* With possible answers: Teachers; Parents; Siblings, cousins; Friends, acquaintances; Recommendations of influencers on social networks - Facebook / Instagram / YouTube; Recommendations in blogs and articles on the Internet and web portals.

For the purpose of the analysis the sample groups of CZ and SK students were tested for differences, using nonparametric Chi square test, testing for statistical significance at p value 0,05. Furthermore, the statistical differences were tested in gender analysis as well at p=0,05. Analysing the specifics of technological skills, we used linear regression analysis to identify the factors that influence the perception of future skills among examined groups.

4. Results

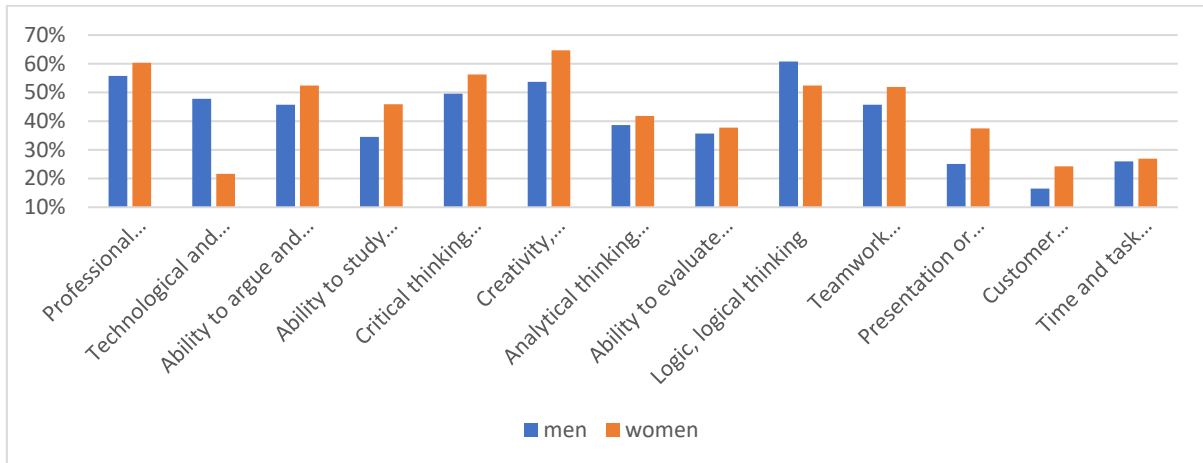
Group sample for examination consisted of total 755 students in secondary education. Sample groups of CZ and SK students were tested for differences based on their answer on the main research question focused on perceived important skills for future. Despite some percentual differences in selected skills, overall group difference was found to be not significant with Chi square statistic equal to 19.65 and p=0.07. Thus, for the further gender analysis, we followed with the analysis of the total research sample of 755 respondents.



Source: Own processing

Figure 1: Percentage comparison based on country of origin of respondents in perceived skills

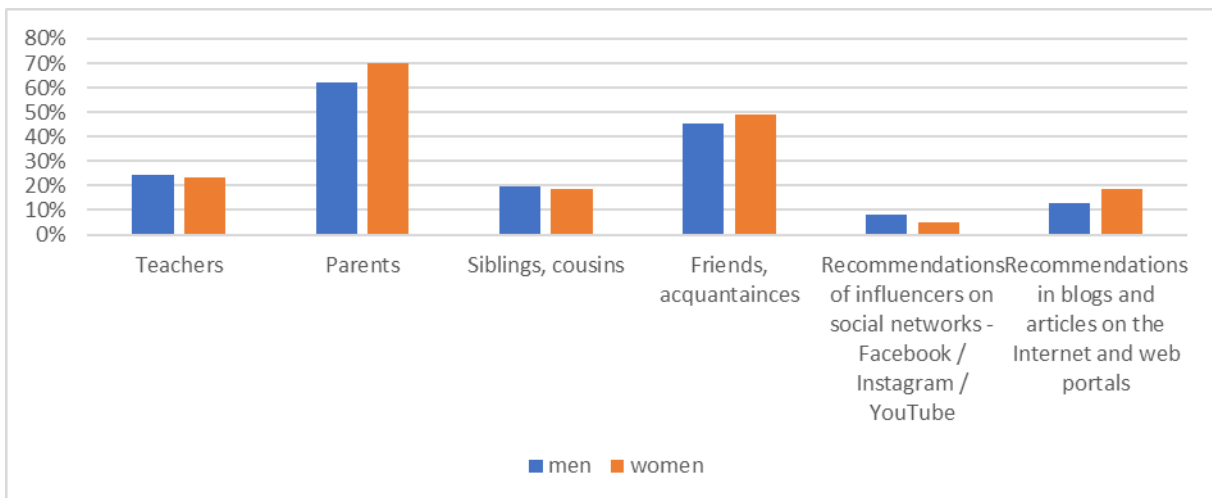
In general assessment of perceived skills for future career of respondents we can observe that most respondents see creativity, innovation and creative thinking (60% of 755 respondents), professional qualification (58%) and logic, logical thinking (56%) as most important. On contrary, as least important they perceived Customer orientation, ability to understand the customer (empathy, attention, perception of context) (21%), time and task management (26%), presentation and communication skills (32%) followed by technological and IT skills (33%). These results point to several issues regarding the human capital competency shifts that are presented in the literature and are important topic in organizations as well. The results however further differ between genders. Presented in Fig. 2, we observe that technological and IT skills are much less perceived as important among women in generation Z (22%) compared to men in generation Z (48%). This difference was found to be statistically significant (Chi square statistic 57,45, p=0). Logic and logical thinking is perceived by 9% more among men than women in our sample. Women in the sample see teamwork as important by 8% more than men, creativity by 11%, ability to study independently by 11% more than men and presentation skills by 13% more than men. In other skills the differences were only slight in favour to women.



Source: Own processing

Figure 2: Percentage comparison based on country of gender in perceived skills

Subsequently, in the analysis, we looked at the possible influence of selected groups or sources of information on students' decisions about their future careers or further education. This research question was based on the assumption that high school students are more strongly influenced by external influences than graduating university students, and so we were interested in what, in addition to themselves, could influence their decision. In the overall group, the parents proved to be the most important for 62% of men and 70% of women. Subsequently friends, acquaintances with 45% among men and 49% among women. In other options, the impacts were perceived significantly less, teachers and siblings around 20% in both groups and the least was recommendations on social media and from influencers. Even with regard to the specifics of Generation Z, it is interesting that the impact of social media and blog recommendations remains relatively low compared to other factors.



Source: Own processing

Figure 3: Percentage comparison in sources of influence on student's future career and education decisions based on gender

When comparing the differences between the examined groups of women and men, a significant statistical difference was found in the case of parents, where women are significantly more influenced by parents than men, with chi-square statistic 4.98, p-value is .026.

Table 2: Chi square test on parents influence on women and men

Category 1	Parents -influence	Parents- do not influence	Row Totals
Women	291 (276.60) [0.75]	125 (139.40) [1.49]	416
Men	211 (225.40) [0.92]	128 (113.60) [1.83]	339
Column Totals	502	253	

Source: Own processing

A significant statistical difference was also found in the case of Recommendations in blogs and articles on the Internet and web portals, where again women are significantly more affected by this source than men in the surveyed group with chi-square statistic 4.59, p-value is .032.

Differences between the surveyed groups point to different types of behaviour of young women and men in the Generation Z. Given that the most significant difference was in the perception of technological and ICT skills for future work, we tested the potential influence of these groups on work or education decisions focused on the use of these skills. Using linear regression analysis, where the dependent variable was the perception of technological and ICT skills and the independent variables were gender and various influences on future careers and education. Only gender showed a statistically significant effect.

Table 3: Regression analysis on technological and ICT skills

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.43	0.04	10.49	0.00**	0.35	0.51
Man/Woman	-0.27	0.03	-8.10	0.00**	-0.34	-0.21
Teachers	0.03	0.04	0.72	0.47	-0.05	0.11
Parents	0.05	0.04	1.27	0.20	-0.02	0.12
Siblings	-0.06	0.04	-1.41	0.16	-0.14	0.02
Friends	0.04	0.03	1.20	0.23	-0.03	0.11
Influencers	-0.06	0.07	-0.81	0.42	-0.19	0.08
Blogs, articles	0.06	0.05	1.26	0.21	-0.03	0.15

** Significance at $p < 0.01$

Source: Own processing

On the contrary, parents proved to be a significant influence in case of dependent variable of professional qualifications. Within the independent variables, a significant positive impact was found for parents, but also for recommendations in blogs and articles. Recommendation and blogs are part of university communication and other educational opportunities as well as job opportunities. The results show that this communication includes professional requirements for the job position or the content and intentions of education.

Table 4: Regression analysis on professional qualification (expertise)

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.43	0.04	9.55	0.00**	0.34	0.51
Man/Woman	0.03	0.04	0.89	0.38	-0.04	0.10
Teachers	0.08	0.04	1.89	0.06	0.00	0.16
Parents	0.13	0.04	3.47	0.00**	0.06	0.21
Siblings	-0.04	0.05	-0.87	0.39	-0.13	0.05
Friends	0.03	0.04	0.97	0.33	-0.04	0.11
Influencers	0.11	0.07	1.44	0.15	-0.04	0.25
Blogs, articles	0.10	0.05	2.00	0.05*	0.00	0.20

** Significance at $p < 0.01$, * Significance at $p < 0.05$

Source: Own processing

5. Conclusion

The topic of new skills for future work is very important, given that it affects not only organizations but also employees and future employees, and related training and education. In our research, we focused on the view of secondary education students on the perception of the necessary skills in their future careers. Unlike other research on skills and competences, this was not a self-assessment, which may be skewed in the case of gender specifics of women (Van Deursen and Van Dijk, 2015), but a perception of the need for these skills in the future. Gender research shows a significant gap between women and men, especially in the field of technology, which was also confirmed by our research. However, the uniqueness of this research lies in the fact that it analysed a group of young people from Generation Z, who are only making decisions about their future careers and future education, and so it was possible to reveal significant gender differences before choosing a future direction. Our results show that women perceive the importance of technological and ICT skills significantly less than men in Generation Z by 26%, with the largest gender difference in all skills examined.

Digital and technological skills in the fourth industrial revolution are not just hard skills, but also a wide range of competencies and skills in the new digital world that will be needed by employees. For example, information skills in the digital world, communication in the digital world, cooperation processes in the digital world, creativity in the digital world or problem-solving in the digital world (van Laar et al. 2020). These skills will differ from the traditional view in the digital world in that a certain level of ICT skills will be required to apply them.

Several studies have discussed the possibilities to learn ICT skills in secondary and higher education through different project tasks, using different technologies or even mobile phones. (León-Pérez et al. 2020) Of course, universities are perceived as an important catalyst for the development of digital and ICT technologies (Miller, Dumford 2015), but in the context of our research the results indicate that significantly lower expectations of women from future work with technological and ICT skills may lead to their decision not to choose technically oriented education, or choose a career path not specifically focused on technology.

The COVID-19 pandemic has also had a significant impact on the shift in the use of ICT and digital technologies not only in the environment of organizations but also in the environment of education (Rouah et al. 2021). Students and teachers were forced to adapt quickly to the virtual environment and overcome the limitations created by the pandemic in the environment. Rodrigues et al. (2021) research points out that students are already exposed to ICT technologies in the secondary education process, and perceives the importance of technology for future careers, although our research points to a still significant gap between genders. Furthermore, during COVID-19 pandemic many new tools and methods have been used or at least introduced in education processes that can be applied for self-study of young adults as well, such as new ways of eLearning and online courses, gamified courses, smart technologies for learning, VR and others. These digital technologies and tools may lead to expanding opportunities for self-study and lifelong learning and will need to be a subject of further academic research.

Finally, the research analysis of the impact on future career and educational decisions revealed the greatest influence of parents and friends, with parents proving to be significantly more important for women. Nevertheless, no direct impact on the perception of the importance of technological and ICT skills was found. On the contrary, parents proved to be important in perceiving the importance of professional qualifications (expertise) for future careers. However, in the context of the Fourth Industrial Revolution, we can expect a change in the settings of the older generations (such as parents in this research) and their perception of technology as part of every job, not only in industry but also in service sectors. Building and developing digital skills and the whole package of related competencies will be essential for organizations and their innovation. Therefore, we see great potential in the effort to change the paradigms of technology perception in the digital world of the present and the future. The research also revealed significant results in the context of the formation of social skills, which are a very important part of the transformation of companies under the influence of the Fourth Industrial Revolution and which must be developed. Our research has shown that less than a quarter of young people in Generation Z consider customer orientation to be an important skill for the future, as well as time and task management, which is very important in building self-management teams, which are one of the new management trends in companies in many sectors.

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