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ARE DIGITAL NATIVES READY TO WORK IN A DIGITALLY TRANSFORMED WORK ENVIRONMENT? UNIVERSITY STUDENTS' PERSPECTIVE

ABSTRACT

The digital transformation is radically changing and will continue to change the work environment and culture. Solutions such as artificial intelligence, machine learning, big data and data analytics, cloud computing, conversational systems, robotics as well as virtual and augmented reality have revolutionized the way we work and the needs and requirements of employees. Completely new goals for work, tasks, and workspace emerge, as well as new challenges to organization, qualifications, employment, and leadership. There are also numerous threats related to the protection of personal data, digital identity management, and cybersecurity, but also in the area of physical and mental health protection against threats resulting from the use of information and communication technologies (ICT). How do *digital natives* deal with these challenges? The study analyses how students perceive the place of digital competencies in the context of the competencies of the future and how they evaluate their own digital competencies. The authors conducted a questionnaire survey among students ($n = 755$) of various faculties, forms of study, and with various professional experience. As the results show, students see the importance of digital competencies, but they rate their own competencies relatively low in this area. Based on the results of the research, recommendations were formulated regarding the shaping of digital competencies among students at universities.

KEYWORDS: *digital competencies, digital literacy, digital natives, digital transformation, work environment, Poland*

INTRODUCTION

The digital transformation greatly accelerated by the COVID-19 pandemic has led to unprecedented digitization of all areas of our lives. It changes the work environment and culture in a very fast and irreversible way. Employers have different needs and requirements. This, in turn, creates new challenges for organization, qualifications, employment, and leadership. The role of Higher Education Institutions is to prepare the next generations of employees and managers and equip them with the competencies of the future, and in the context of the digital revolution, in particular digital competencies. Contrary to the assumption that today's youth, often branded as *digital natives*, inherently possess digital competencies due to their exposure to media-rich

environments and constant connectivity, challenges persist (Porat et al., 2018). The acquisition of digital skills is considered a prerequisite for students in higher education to successfully navigate educational programs and acquire professional competencies. However, this assumption encounters challenges, as some students lack the necessary digital literacy for effective digital learning upon entering higher education. These challenges extend to various aspects, including problem-solving, and attitudes aligned with strategic and responsible use of these skills. For instance, students may face difficulties in engaging thoughtfully in online learning, evaluating and integrating digital information effectively, critically judging the suitability of online information, understanding the ethical and social usage of information, interpreting references to papers or journals, searching databases effectively, and regulating and discerning the validity and value of information found online. Furthermore, comprehending copyright issues related to digital information sharing adds another layer of complexity (Vissers et al., 2018; Tang and Chaw, 2016).

Addressing these challenges is crucial to ensuring that students are equipped with the necessary digital competencies to thrive in the contemporary digital landscape and the future digital work environment. Consequently, the aim of this paper is to analyze how students perceive the place of digital competencies in the context of the competencies of the future and how they evaluate their own digital competencies.

The paper is organized as follows: In the next section, the digital transformation of the workplace and the future competencies adjusted to this transformation are discussed. Then, the methodology is outlined, followed by the presentation of results. Finally, the discussion and conclusion section presents recommendations for the higher education sector, along with the limitations and future research directions.

DIGITAL TRANSFORMATION AND THE WORK ENVIRONMENT

Initially, it was assumed that Industry 4.0 and the associated digital transformation would result in a massive replacement of workers by robots. Frey and Osborne (2017) estimated that approximately 47% of jobs in the US are at risk of being automated. Similar estimates were made for the EU – Bowles (2014) found that 47% of jobs in Sweden to over 60% of jobs in Romania are to be automated. However, as it was noted over time, the impact of automation and robotization on jobs should be analysed from the perspective of tasks, not profession – in this approach, it is estimated that the threat appears to 9% of jobs in the US and in the range from 7% (Finland) to 33 % (Slovakia) in Europe (Arntz et al., 2016). Thus, the revolutionary impact of digital transformation on the labour market is not about job losses, but about the new roles of workers. And this, in turn, requires a new set of competencies – not only digital ones.

Numerous analyses consistently document substantial transformations with implications for a significant portion of the global workforce (Szabó-Szentgróti, Végvári and Varga, 2021). The advent of powerful artificial intelligence tools, exemplified by ChatGPT and Google's Bard, has catalyzed extensive discourse regarding the potential displacement of human labour by *robots*. Investigations suggest that certain occupations, including some traditionally considered white-collar, may experience substantial repercussions. According to a recent assessment by Goldman Sachs, approximately 300 million jobs are poised to be influenced by generative AI, signifying a potential automation rate of 18% across global employment. This impact is expected to be more pronounced in advanced economies compared to emerging markets. The World Robotics 2023 Industrial Robots and Service Robots report reveals a noteworthy surge, indicating the installation of 553,052 industrial robots in global manufacturing facilities in 2022, reflecting a year-over-year growth rate of 5%. Regionally, the distribution of newly implemented robots is characterized by 73% in Asia, 15% in Europe, and 10% in the Americas, as reported by the International Federation of Robotics (IFR, 2023). The evolving landscape of automation

technologies underscores the importance of understanding and addressing the multifaceted implications for the global workforce and its competencies.

However, emerging technologies are also anticipated to foster the creation of novel employment opportunities. Several contemporary studies indicate that the positive impact of these technologies on job generation outweighs their displacement effects, leading to net growth in employment (for instance, Arntzet al., 2019). According to the Boston Consulting Group (BCG) analysis, new technologies will lead to tens of millions of job vacancies by 2030. The increasing integration of AI into various sectors has fueled demand for AI specialists, data scientists, and machine learning engineers. The World Economic Forum estimates that by 2025, AI-related roles will account for a significant percentage of new job opportunities (World Economic Forum, 2020). Furthermore, the rise of the Internet of Things (IoT) has led to a surge in demand for professionals skilled in designing, implementing, and securing interconnected systems. Forecasters project that IoT-related occupations will experience substantial growth, with millions of jobs being created globally (McKinsey & Company, 2019). Augmented and virtual reality (AR/VR) technologies represent another domain fostering new job prospects. The development of immersive experiences, software design for virtual environments, and AR/VR content creation are emerging as critical skills. Research by PwC suggests that AR/VR could contribute trillions to the global economy by 2030, creating millions of jobs in the process (PwC, 2019).

Without a doubt, the development of new technologies is causing a profound transformation of the labour market, characterized by the simultaneous disappearance of millions of existing jobs and the creation of new jobs. While this change may initially seem to have little impact, researchers say its consequences go far beyond simple numerical fluctuations. Therefore, it is extremely important to move beyond a narrow focus on the overall net employment surplus or deficit. Beneath this seemingly simple equation lies a complex landscape characterized by significant supply and demand imbalances across job categories and geographies. The assumption of perfect interchangeability is considered unrealistic, recognizing that not all surplus labour potential can smoothly meet emerging needs in other sectors. As a result, there is a noticeable discrepancy between jobs expected to be lost and those expected to be in high demand,

underscoring the challenge of how labour market dynamics impact the skill set of current and future workers. Addressing this disparity is necessary to support a workforce that can cope with the transformative effects of emerging technologies on the employment landscape. It is also crucial from the perspective of business workforce transformation. Survival in the era of digital transformation is contingent upon employees in companies who align themselves with the rapid advancements in technology propelled by innovation accelerators. These accelerators encompass a spectrum of technologies, including the Internet of Things (IoT), Industrial Internet of Things (IIoT), 3D printing, process mining, machine learning, artificial intelligence, augmented and virtual reality, blockchain, nanotechnology, cloud computing, big data, and various others. Only in firms where employees adapt to and embrace these technological changes will resilience and success in the face of digital transformation be achievable.

One of the primary challenges confronting today's job market and institutions responsible for preparing the workforce, particularly Higher Education Institutions, revolves around the crucial theme of digital transformation and the emergence of Industry 4.0, as we approach the impending shift to Industry 5.0. The growing prevalence of automation, robotization, and digitization significantly shapes the work environment, work culture, and the necessary skills (Da Silva et al., 2020; EC, 2019; Chen et al., 2020; Sharma et al., 2020). Beyond the overarching impact of the ongoing digitalization on our societal fabric and daily lives, new technologies are fundamentally reshaping the nature of work itself (e.g., Murawski & Bick, 2017). The constant renewal of devices and software programs in professional settings seeks enhanced efficiency and streamlined work processes. This paradigm shift necessitates an increased reliance on digital information and communication technology (ICT) in the workplace. Indeed, the substantial integration of digital ICT is evidenced by a robust 83% of participants in a comprehensive representative sample of the German workforce acknowledging its use (Arnold, Butschek, & Steffes, 2016). Basic digital competencies have become a prerequisite in most workplaces, as highlighted by Gallardo-Echenique et al. (2015). This emphasis on digital skills dates back to as early as 2006 when the European Parliament and the Council recognized digital competence as one of the eight key competences for lifelong learning (van Laar, van Deursen, van Dijk, & de Haan, 2017).

FUTURE COMPETENCIES AND DIGITAL COMPETENCIES

The contemporary landscape of the labor market is undergoing a profound transformation fueled by the relentless pace of digitalization. According to the World Economic Forum (2020), a staggering 84% of employers across 15 industry sectors spanning 26 advanced and emerging countries are actively engaged in rapidly digitalizing their work processes. This includes a substantial expansion of remote work, with the potential to transition over 40% of their workforce into remote operations.

Digital competence has been conceptualized under various terms such as digital literacy, digital capacity, e-literacy, e-skills, e-competence, computer literacy, and media literacy, reflecting its diverse manifestations across policy documents, academic literature, and educational practices (Gallardo-Echenique, 2015). The International Computer and Information Literacy Study (ICILS) defines digital literacy/competence as an individual's capacity to use computers for investigation, creation, and communication, enabling effective participation in home, school, workplace, and community settings. A comprehensive conceptual model of digital competence, proposed by the European Commission Joint Research Centre (AlaMutka, 2011), includes instrumental knowledge and skills for using digital tools, advanced capabilities for communication, collaboration, information management, learning, and problem-solving, and meaningful participation, as well as attitudes related to strategic use of these skills in intercultural, critical, creative, responsible and autonomous ways.

In the workplace context, digital competencies encompass a spectrum of fundamental knowledge, skills, abilities, and traits that enable individuals to efficiently and successfully execute digital media-related tasks at work (Oberländer et al., 2020). The future workforce's digital competencies extend beyond technical skills, incorporating interdisciplinary abilities like digital literacy, critical thinking, and adaptability, which are becoming increasingly crucial. Warhurst and Hunt (2019) highlight the dynamic nature of occupational compositions and skill profiles influenced by interactions with new technologies, underscoring the pivotal role of digital skills in addressing challenges such as increasing competitiveness, fostering economic growth,

and mitigating inequalities. As industries adopt emerging technologies, professionals with the capacity to integrate diverse skill sets are highly sought after. This dynamic shift in the work environment not only necessitates the acquisition of new skills but also underscores the urgency for continuously updating existing ones. In response to these changes, there is a growing emphasis on equipping individuals, particularly students, with the competencies required to navigate the opportunities and challenges presented by emerging technologies.

MATERIALS AND METHODS

In this study, the evaluation of digital competence is grounded in the standards outlined in the *Guidelines for the implementation of projects using European Social Fund funds in the field of education for 2014-2020*. These standards were formulated based on the outcomes of the DIGCOMP project, an initiative executed by the Institute for Prospective Technological Studies in Seville. The DIGCOMP project, in turn, was founded on an in-depth analysis of the existing framework of digital competences as part of the broader EU DIGCOMP project, ultimately leading to the development of a comprehensive Digital Competence Framework. This framework encapsulates the multifaceted aspects of digital proficiency and provides a structured lens through which the respondents' capabilities are gauged.

To operationalize the assessment of digital competencies in line with the established framework, a structured survey questionnaire was developed with a total of 26 questions. Of these, four questions concerned socio-demographic aspects, while the remaining 22 aimed to examine dimensions directly related to the research problem under study.

The questionnaire was distributed to respondents following the standards of the CAWI technique. The study participants were students of various private universities in Poland, which provided a solid and diverse research sample. The study successfully collected responses from a total of 755 participants. Table 1 presents the socio-demographic data of the study participants.

Table 1. *Socio-demographic data of the respondents.*

Variable		N	%
Gender	Female	514	68,1
	Male	241	31,9
Age	17-30	619	82
	31-40	117	15,6
	41-50	18	2,4
Form of Studied	Full-time	231	30,6
	Part-time	396	52,4
	Online	128	17
Work experience	Full-time	259	34,4
	Part-time	164	21,7
	Internship	161	21,3
	None	171	22,6

The study results were prepared in detail and subjected to statistical analysis using the widely recognized SPSS Statistics tool for quantitative data research. In the next section, the results of the study will be presented and analyzed, providing valuable insight into students' digital competencies and contributing to the broader discourse on digital literacy in educational contexts.

RESULTS

This section presents an in-depth analysis of the perceived digital skills among Polish University students. The results of this survey research will be presented from the gender perspective.

In the realm of information searching and organization, the collected data reveals that 57.91% of women demonstrate intermediate skills in effective online information browsing, while 25.76% have reached an advanced level. Comparatively, among men, 53.58% display intermediate skills, with 34.57% at an advanced level. This higher percentage of men with advanced

skills may suggest a heightened interest in these areas among this group. When it comes to gathering, processing, understanding, and critically evaluating information, the majority of respondents exhibit skills at intermediate and advanced levels. In the female group, 51.57% possess intermediate skills, and 32.01% showcase advanced skills. For men, these figures stand at 42.68% and 40.69%, respectively. This indicates that women more frequently possess the ability for critical analysis of information.

The analysis also sheds light on storing and retrieving information, indicating a relatively high level of skills among respondents. Among women, 52.16% have intermediate skills, while 26.29% exhibit advanced skills. For men, these figures are 47.99% and 37.88%, respectively, suggesting that women may be more organized in managing digital resources. Digital communication and applications showcase well-developed skills among most respondents, with both women (47.31% intermediate, 34.13% advanced) and men (42.56% intermediate, 40.67% advanced) operating at similar levels in terms of digital communication.

In the realm of sharing information and resources, the analysis reveals that 42.69% of women and 38.79% of men possess intermediate skills, while 33.22% of women and 39.28% of men demonstrate advanced skills. These findings suggest that women more frequently engage in online resource sharing. Regarding digital collaboration, 50.94% of women and 45.30% of men exhibit intermediate skills, while 28.10% of women and 32.30% of men showcase advanced skills, potentially indicating that women more often participate in online teamwork.

Most respondents demonstrate a good understanding and application of netiquette, with 50.75% of women and 47.54% of men having intermediate skills, and 29.46% of women and 29.99% of men possessing advanced skills. This proficiency is crucial for responsible use of social media and online communication. In terms of digital identity management, 48.36% of women and 46.75% of men exhibit intermediate skills, while 29.80% of women and 30.96% of men possess advanced skills. This may signify the growing importance of managing an online identity.

Content creation skills are relatively balanced between women (53.85% intermediate, 30.76% advanced) and men (50.57% intermediate, 30.33% advanced),

suggesting a similar level of proficiency in online content creation. In content integration and processing, 52.48% of women and 47.22% of men have intermediate skills, while 31.85% of women and 32.67% of men exhibit advanced skills, indicating effective processing of content online. In compliance with copyright and licensing, 51.27% of women and 52.85% of men have intermediate skills, while 24.39% of women and 22.42% of men demonstrate advanced skills, highlighting the importance of avoiding copyright infringement on the internet.

Programming skills, considered a key skill for the future, are demonstrated by 42.54% of women with intermediate skills and 21.55% with advanced skills. Among men, these figures are 41.79% and 22.15%, respectively. Protective tools for online security are well-utilized, with 57.13% of women and 53.03% of men possessing intermediate skills, and 23.97% of women and 25.01% of men demonstrating advanced skills, underlining the increasing importance of online protection.

Personal data protection skills are also notable, with 58.53% of women and 53.74% of men possessing intermediate skills, and 24.44% of women and 26.53% of men exhibiting advanced skills, indicating a keen awareness of the importance of protecting personal data for online privacy. Concerning physical and mental health protection, 46.82% of women and 51.25% of men have reached an intermediate level, while 30.61% of women and 27.93% of men demonstrate an advanced level. This suggests that both women and men are conscious of the impact of technology on health.

Technical problem-solving skills, crucial in the current technological era, are demonstrated by 53.82% of women with intermediate skills and 49.78% with advanced skills. For men, these figures are 23.66% and 26.84%, respectively. Recognizing needs and choosing appropriate tools are considered key in efficient technology use, with 51.09% of women and 47.43% of men reaching an intermediate level, and 22.63% of women and 21.07% of men exhibiting advanced skills.

Innovation and creative use of technology are showcased by 50.83% of women with intermediate skills and 48.86% with advanced skills. For men, these figures are 21.27% and 19.73%, respectively, highlighting the potential for the development of various fields through innovative use of technology. Recognizing competency gaps is crucial for continuous development, with

51.06% of women and 50.20% of men possessing intermediate skills, and 24.35% of women and 25.08% of men demonstrating advanced skills. Concerning competency development by universities, most respondents believe that their university adequately develops the digital competencies required for entering the job market, with a prevailing average rating of 3 out of 5. However, there is potential for further improvement in educational programs.

The presented key findings indicate a substantive representation of women possessing intermediate to advanced proficiencies in areas such as efficient online information retrieval and organization, with a noteworthy emphasis on their superior capabilities in critical evaluation and analytical processing of information. This trend underscores a gendered dimension in digital literacy, particularly highlighting women's adeptness in managing and organizing digital resources.

Furthermore, the results delineate a comparative parity between genders in digital communication and content creation skills. Notably, it underscores a greater propensity among women for active participation in online resource sharing and digital collaboration, suggesting a gender-influenced variance in online engagement and teamwork dynamics.

The analysis also brings to the fore the criticality of netiquette understanding, digital identity management, and the imperative of safeguarding personal data, illustrating a near-equivalent competence level across genders. Proficiencies in programming and the utilization of online protective measures are similarly distributed, indicating a gender-neutral distribution in these technical skills.

Crucially, the research sheds light on the consciousness regarding the impact of technology on physical and mental well-being, a domain where both genders demonstrate substantial awareness. The ability to troubleshoot technical issues, identify requisite digital tools, and harness technology innovatively is uniformly evident across gender lines.

CONCLUSIONS AND RECOMMENDATIONS

In our contemporary, highly interconnected, and technologically enriched world, the imperative for university students to cultivate a diverse skill set, coupled with adaptability and flexibility, has never been more pronounced. The future workplace is undergoing rapid transformation, primarily propelled by digital disruption across diverse industries. This disruption in the education sector signifies a sudden and transformative interruption, ushering in changes that redefine the very essence of learning quality.

The digital competencies required for the future workforce extend beyond technical expertise to encompass a diverse set of skills that promote adaptability and cross-disciplinary collaboration. While concerns about job displacement persist, the evidence suggests that emerging technologies create new and diverse employment opportunities. Stakeholders in education, industry, and policymaking must collaborate to cultivate a workforce equipped to navigate and harness the potential of the evolving job landscape shaped by digital innovation. The forecasts discussed underscore the imperative for proactive skill development and continuous learning to ensure the resilience and competitiveness of the workforce in the face of technological advancements.

The progressive surge of digitization is rapidly shaping the labour market, unveiling trends that are increasingly discernible. These transformative trajectories intricately influence the cultivation of broadly defined digital competencies within educational frameworks. The evolving nature of professions and the uncertainty surrounding their future configurations prompt a fundamental question: What set of competencies, irrespective of specific professions or roles, should be instilled in students to empower them for active participation in the evolving labour market?

The metamorphosis of the labour market is marked by unpredictability—what professions will endure in their current form, which will undergo significant transformations, and to what extent these changes will manifest remain uncertain. In light of this ambiguity, there is an urgent need to delineate a set of competencies that can empower students to competitively navigate the dynamic labour market landscape. Employers, amid these changes, anticipate a broader spectrum of competencies, recognizing that many professions may

either disappear or metamorphose into specialized forms of work. These transformations hinge on a robust foundation rooted in the intersection of social and digital technologies, emphasizing the importance of holistically related skill sets to meet the demands of the evolving professional terrain.

The study results reveal a comprehensive analysis of digital competencies across various domains, shedding light on gender-based differences and commonalities. In information searching and organization, men show a higher proportion of advanced skills, potentially indicating a greater interest in these areas. Critical evaluation of information leans slightly toward women, emphasizing their analytical abilities. Notably, women exhibit higher proficiency in storing and retrieving information, suggesting a more organized approach to managing digital resources. In digital communication, both genders demonstrate similar levels of skills. However, women surpass men in sharing digital resources and engaging in digital collaboration, suggesting a more collaborative online presence. In areas like netiquette and digital identity management, both genders exhibit a strong understanding and application of rules, emphasizing responsible online behaviour. In content creation, content integration, and processing, women and men display comparable levels of proficiency. Compliance with copyright and licensing shows gender-balanced intermediate skills. The study underscores the importance of programming skills for future work, with both genders demonstrating intermediate proficiency. In protective tools and personal data protection, women exhibit a marginally higher proportion of advanced skills. Both genders are mindful of the impact of technology on health, indicating an awareness of physical and mental health protection. Technical problem-solving skills are robust among both genders, a vital competency in the current technological landscape. Recognizing needs, choosing appropriate tools, and fostering innovation through creative technology use are areas where both women and men display comparable levels of proficiency. Recognizing competency gaps is a shared strength, essential for continuous development. Respondents generally believe that their universities adequately develop digital competencies, indicating a potential for further improvement in educational programs. The study provides a nuanced understanding of the digital competency landscape, emphasizing both gender-specific trends and shared strengths across various domains.

In its concluding observations, the paper posits that while universities are making significant strides in equipping students with necessary digital competencies for the modern workforce, there exists a potential for enhancing and refining educational curricula in this domain. This aspect of the analysis underscores the ongoing need for educational institutions to adapt and evolve in response to the dynamic requirements of digital proficiency in the contemporary job market.

Based on the results, the authors have developed the following recommendations for the higher education sector:

- Integration of digital competence development into the core curriculum, ensuring that all students graduate with a baseline of essential digital skills.
- Implementation of faculty training programs to equip educators with the necessary skills to effectively integrate technology into their teaching methods and serve as role models for digital competence.
- Promotion of interdisciplinary digital projects that encourage collaboration between students from different fields, fostering a holistic understanding of technology applications in diverse contexts.
- Establishment of partnerships with industries to create experiential learning opportunities, internships, and mentorship programs, aligning educational outcomes with the evolving needs of the job market.
- Development of comprehensive digital literacy initiatives accessible to all students, irrespective of their socio-demographic backgrounds, ensuring an inclusive and supportive learning environment.
- Implementation of regular assessments of students' digital skills throughout their academic journey, allowing for targeted interventions and adjustments in educational strategies as needed.
- Offering flexible learning modalities, including online courses, workshops, and webinars, allowing students to choose the format that best suits their learning style and schedule.
- Establishment of dedicated digital learning hubs on campuses, equipped with state-of-the-art technology and resources, serving as spaces for collaborative learning and experimentation.

- Development of mentorship programs connecting experienced professionals with students, providing guidance on navigating the digital workforce and fostering a sense of community within the institution.
- Fostering an institutional culture that embraces adaptability and responsiveness to technological advancements. Regularly assess and update digital competence strategies to stay ahead of evolving trends in the digital landscape.

Our research on digital competencies among Polish university students comes with inherent limitations that pave the way for potential avenues of future investigation. The primary limitation arises from the geographical scope of the study, which was confined to the territory of Poland. Considering that the concept of digital competencies can be influenced by the country and culture, it is advisable to extend the research to encompass other nations in subsequent studies, such as exploring the region of Central and Eastern Europe or the broader European Union. Additionally, our research methodology involved capturing the opinions of students at a certain time. The authors acknowledge that these opinions are subject to change over time, and thus, there is an opportunity for future research to employ longitudinal approaches to understand how perceptions of digital competencies evolve among Polish university students.

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