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DIGITAL COMPETENCES OF UNIVERSITY GRADUATES: IMPLICATIONS FOR CAREER SUCCESS

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Abstract: *The role of university graduates' digital competences in their professional careers was analyzed using the Digital Competence Framework for Citizen 2.2. The study was conducted in Ukraine, where a siginificant share of employment during the war is remote (or at least hybrid), requiring the posession and continuous improvement of digital competences. The results are based on a sociological survey of 397 graduates under the age of 35 with professional experience ranging from one year to more than ten years in labor market. To understand career success, respondents were divided into groups: employees in non-managerial positions, middle managers, top managers, and unemployed. The analysis revealed that university education has a significant impact on the formation of digital competences – greater progress occurs during university studies rather than at workplaces. Higher career success (top management positions) is characteristic of respondents with better-developed digital competences, particularly in digital data management, information evaluation, digital communication, and creative use of technology..*

Keywords: *digital competences, DigComp 2.2, employment, university graduates, career success.*

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INTRODUCTION

In the era of rapid technological development, digital competences have become an indispensable component of employability across nearly all spheres of human activity. The shortage of digital skills and the urgent need for their development remain key challenges in shaping professional competences. At the European Union (EU) level, this has been formaly recognized in Decision 2023/936, which designated the period from 9 May 2023 to 8 May 2024 as the European Year of Skills (EUR-Lex, 2023). According to recent assessments (European Union, 2025), the deficit of transversal competences – among which digital competence plays a pivotal role – is particularly crucial. Digital competence not only has a direct impact, for example through communication but also an indirect one, by fostering critical and innovative thinking, interpersonal and intrapersonal skills, and global citizenship). The European labor market is already experiencing profound transformations due to digitalization and artificial intelligence (AI). Current projections suggest that 32% of jobs may undergo substantial changes due to AI, while 24.5% of candidates lack transversal competences, particularly those relevant to the green and digital transitions. The impact is especially pronounced on small and medium-sized enterprises (SMEs), where 62% report an urgent need for stronger digital competences (European Union, 2025).

Against this backdrop, universities and the labor market often face a structural skill gap. The pace of technological change outstrips universities' capacity to adapt curricula, resulting in a mismatch between the digital competences acquired during studies and those required in professional environmens. This problem has been widely acknowledged in both academic and applied research. In the meantime, digital competences offer significant professional advantages, enhancing productivity (Hadiansyah et al., 2024; Saeful & Ekhsan, 2024), employability (Avram et al., 2021; Iwashita et al., 2021; Wang et al., 2023), and ultimately, individual benefits in terms of higher income and competitivemness.

In accordance with the Recommendation of the European Parliament and of the Council of 2006 and 2018, *digital competence* was recognized as one of the key competences for lifelong learning (European Commission, 2006; European Commission, 2018), and in 2020 it was classified as a basic skill necessary for ensuring sustainable development and social justice (European Commission, 2020).

In the Council Recommendation on key competences for lifelong learning, *digital competence* is defined as the one that "involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society" (European Commission, 2018). According to the European Training Foundation, "digital competence referred to as digital literacy, encompasses a set of basic digital skills, covering information and data literacy, online communication and collaboration, digital content creation, safety and problem solving" (Brolpito, 2018). Mobile technology tools such as iPads, iPad mini, mobile applications, tablets, palm devices, e-readers and smartphones are becoming real-world tools that should be integrated into modern instructional practices to support digital learners and to promote meaningful learning (Arokiasamy, 2017). Thus, digital competences may range from technical competences, such as the use of software and hardware, to cognitive competences, such as evaluating online information, collaborating in a digital environment, and maintaining digital safety.

Therefore, acquiring and further developing digital comptence has become essential for everyday life and a fundamental competence for full participation in the digital society (Chovanova Supekova et al., 2023; Sydorchuk et al., 2024; Warschauer, 2003). As noted by Kovacs & Vamosi Zarandne (2022), digital skills are increasingly regarded as *must-have soft skills*, not only in the professional sphere. According to the European Commission (2022), basic digital skills are indispensable for daily life and employability, underpinning engagement in the digital world, they have become necessary for both daily lives and employability, setting foundations for embracing the digital world; it is projected that in the near future, 9 in 10 jobs will require such skills. Job vacancy analyses indicate that employers often expect candidates to have data visualization skills, such as proficiency in Tableau, Google Charts, Microsoft Power BI; knowledge of data visualization principles and best practices; and famiiliarity with programming languages such as R and Python (Zavyiboroda, 2022). For this reason, an important aspect of governing policy in many developed countries is guaranteeing citizens' basic rights, including support for acquiring digital skills, which will contribute to a more just and economically successful society (Brynjolfsson & McAfee, 2014; Mishchuk, 2019; Kangalakova et al., 2025).

The European Commission (EC) has repeatedly held consultations with stakeholders to develop and update digital competence frameworks for learning and employability. In 2022, the European Commission (EC) published the Digital Competence Framework for Citizen 2.2, which includes five competence areas (information and data literacy; communication and collaboration; digital content creation; safety; and problem solving) and eight proficiency levels, ranging from foundational to highly specialized (Vuorikari et al., 2022). Today, DigComp 2.2 is considered a pan-European tool for improving citizens' digital competence, supporting policy development in this field, and planning educational initiatives aimed at raising the digital competence of specific target groups.

For a long tome, the dominant approaches to measuring digital competences included: 1) self-assessment of respondents' skills, which formed the basis of two large-scale population survey projects, Web Use (Hargittai, 2005) and Digital Skills to Tangible Outcomes (Helsper et al., 2015; van Deursen et al., 2016); 2) performance tests, requiring respondents to complete specific tasks during the study. These methods often start with researchers' overestimated expectations about respondents' digital competences, which complicates the objectivity of assessing novice users. Another problem is that the assessment of digital competence is often reduced to overly generalized characteristics, based on the ITU classification (2018). However, even such approaches make it possible to identify a digital competences deficit. For example, results of an analysis of digital competences development in Ukraine showed their overall low level and only modest progress (the share of the population with *No skills* and *Low skills* decreased from 53.0% in 2019 to 47.8% in 2021) (Ministry of Digital Transformation of Ukraine (2021). A survey of Ukrainian civil servants also revealed an insufficient level of certain digital skills, with the most obvious gap being the area of «digital content creation» (Bilan et al., 2023).

A number of studies conducted by Barnard et al. (2013), William et al. (2017), Pachis (2018), Cruz-Jesus (2018), Aikins (2019), Fang et al. (2019), Otioma et al. (2019), Song et al. (2020), Huxhold et al. (2020), Peine & Neven (2021), Vercruyssen et al. (2023), and Livingstone et al. (2023) have shown that the level of digital literacy and competences depends on factors such as age, gender, education, social status, urbanization, income level (including

in rural areas), internet cost, economic freedom, access to electricity, self-efficacy, extraversion, and openness to experience.

In the context of digital transformation of the economy, especially in the post-pandemic period, digital skills have become one of the competencies determining success in professional activity – not limited to the IT market and e-commerce, with which digital competences were previously strongly associated. Among the sectors where demand for digital competence has grown significantly due to the need for digital tools are: financial and insurance companies (Csiszárik-Kocsir, 2022; Mazurchenko et al., 2022; Roy & Vasa, 2024), the tourism industry (Carlisle et al., 2023; Keller & Printz-Markó, 2023), educational institutions (Kupchyk et al., 2025; Rubach & Lazarides, 2021; Staniec et al., 2023), public administration (Bilan et al., 2023; Ortina et al., 2023; Szedmák et al., 2025), healthcare sector (Kerr & Houten, 2020; Lukács et al., 2023), industrial technologies (Hossain et al., 2025; Smieszek, 2019), etc. The demand for digital competence extends even to music education, where students are actively involved in designing and creating musical instruments through digital technologies (Falkenberg et al., 2020).

Digitalization of different sectors contributes to economic growth and macroeconomic stability (Oliinyk et al., 2021). Contemporary research on sustainable development emphasizes the role of smart technologies in transforming transport and logistics systems, particularly in developing digital competences for effective management (Vovk et al., 2025). Furthermore, the integration of transport management systems demonstrates significant positive correlations with organizational performance, highlighting the importance of digital skills in modern logistics environments (Makheti & Nyile, 2025). Successful use of e-government opportunities has helped reduce corruption and increase transparancy in public dialogue (Androniceanu et al., 2021; Androniceanu et al., 2022; Bilozubenko et al., 2025; Darmawati et al., 2024), improve public service quality (Badruddin & Yapid, 2019; Scupola & Mergel, 2022), and expand opportunities for cooperation with business and the community to achieve strategic goals (Bartuseviciene & Butkus, 2024: El Ammar & Profiroiu, 2022), including sustainable development (Zahid & Haji Din, 2019; Burlacu et al., 2021). At the same time, skepticism about digital competences also exists in academia. Some scholars have questioned whether digital competence directly translates into economic success or other positive social outcomes (Straubhaar et al., 2012).

Overall, the development of employees' digital skills has facilitated the successful use of competitive advantages and helped avoid or mitigate economic disruptions, the risk of which was high during the COVID-19 pandemic. Unsurprisingly, that period saw an incrrease in the use of remote learning and empoyment methods, particularly telework (Avram et al., 2021; Iwashita et al., 2021; Lipták et al., 2023). Company leaders recognized the importance of systematically implementing digital skills development approaches at the strategic level (Mazurchenko et al. 2022), which also became relevant for SMEs (Korcsmáros et al., 2025; Tutar et al., 2024). Incorporating professional development programs into employer value propositions became relevant and widespread (Samoliuk et al., 2022). However, companies' choices of digital training types for staff differ significantly, especially by company size – micro and small enterprises have fewer opportunities. Kergroach (2020) observes that the factors shaping this issue present a complex interplay, involving time constraints, finnancial resources, the availability of tailored training opportunities, awareness of free or subsidized online learning networks, and the adequacy of provision to address digital skills needs.

Tinmaz et al. (2022) highlight the impact of digital literacy on various aspects of human life, such as education, business, health, and governance. Other studies have shown that digital competences have a significant impact on employee productivity (Hadiansyah et al., 2024; Saeful & Ekhsan, 2024). At the same time, a study conducted in rural China between 2014-2018 demonstrated that acquiring digital competences among the rural workforce contributed to rural employment and entrepreneurship: each 1% increase in digital skills raised non-farm employment and entrepreneurship by 3.03% and 2.11%, respectively (Wang et al., 2023).

However, many recent studies emphasized the fact that there is a gap between the existing and needed digital competences to respond to the challenges of the digitalized workplace in the future (Siddiqui et al., 2022; Mazurchenko et al., 2022; Oberländer et al., 2020; Lingga, 2020). For example, a nationwide German survey in 2016 revealed that more than two-thirds of employees constantly feel the need to improve their competences at work due to technological innovations (Arnold et al., 2016). Similarly, a survey of public sector employees in South Africa revealed a significant shortage of advanced digital skills, particularly in areas such as Artificial Intelligence and Big Data, alongside a smaller gap in intermediate skills and overall lack of qualified professionals to fill various digital positions in the sector (Manana & Mawela, 2022; Yarovenko et al., 2024). These competences are coming increasingly important and often determine successful employment (Woźniak-Jęchorek, 2023), as well as business model success, such as improving supplly chains (Golubtsov et al., 2025) and developing the creative economy (Schinello, 2025).

Difficulties in acquiring and applying digital competences are also typical for graduates of educational institutions, who often note a mismatch between their current level of competences and labor market requirements (Pažur et al., 2023). Morgan et al. (2022) studied the perceptions of Australian students regarding their digital literacy. It was found that the lowest skill levels were in "using digital information, specifically in terms of evaluation and determining bias and quality of information" and "the highest levels of proficiency were for social literacy skills, such as communicating appropriately online" (Morgan et al., 2022, p. 1). Additionally, work experience and length of time in higher education had positive effect on digital literacy levels (Morgan et al., 2022). In the meantime, a survey of 4,880 registered members of a professional association of Business and Economics graduates revealed that four out of the five analyzed dimensions of digital competence (communication, content creation, safety and problem solving) influenced candidates' suitability for jobs (Periáñez-Cañadillas et al., 2019). These same trends are observed in the modern labor market, where digital skills are a typical requirement for qualified workers, often emphasized in job vacancy descriptions (Roshchyk et al., 2024).

All digital skills develop over time in both formal and informal educational environments (Leahy & Wilson, 2014). In this regard, Romi (2024) stressed the importance of paying greater attention to the adaptability of curricula and training courses to bridge the digital skills gap between those acquired in education and those required by employers.

Despite extensive research on digital competences, important gaps remain. Much of the literature (Barnard et al., 2013; Huxhold et al., 2020, Livingstone et al., 2023, Otioma et al., 2019; Song et al.2020; Peine & Neven, 2021; Vercruyssen et al., 2023) has concentrated on the determinants of digital competence acquisition at the individual level, including demographic and sociocultural factors, opportunies, and constraints. Similarly, other works have examined the impacts of digital competences at different scales – individual, business,

and macroeconomic (Mazurchenko et al., 2022; Melnyk et al., 2025; Periáñez-Cañadillas et al., 2019; Oliinyk et al., 2021; Roshchyk et al., 2024; Samoliuk et al., 2022). However, relatively little is known about which specific digital competences contribute most to career success. While sector-specific requirements for hard digital skills are undeniable, a set of transversal skills – such as the ability to search, filter and evaluate data, communicate securely and effectively, and creatively use digital content, etc. – may represent universal components of career success.

The present study addresses this gap by identifying the digital competences most strongly associated with professional advancement and higher earnings. We do so in the context of Ukraine, a country undergoing accelareted digital transformation under the extraordinairy pressures of war, where digitalization is being rapidly integrated across sectors – particularly employment – for security reasons.

Given the above, our study ***aims*** to assess the role of university graduates' digital skills in their professional careers.

Our analysis is guided by the following research questions (RQs):

RQ1: Is university education an effective driver of digital competences development, or are these competences primarily acquired independently in the workplace?

RQ2: Which digital competences are most developed among graduates who have achieved career success as top managers, and how dot they differ from those of graduates with more modest career achievements?

RQ3: Which digital competences are characteristic of graduates with the highest income levels?

To answer these questions, we conducted a sociological survey of university graduates under the age of 35, currently employed in diverse roles in Ukraine and abroad, as well as among entrepreneurs and unemployed graduates. To our knowledge, this is the first study that measures both the development and practical use of digital competences among graduates with diverse professional experience, covering all 21 competences defined in the Digital Competence Framework for Citizen 2.2 (DigComp 2.2). The findings provide important insights for the improvement of degree programmes and for strengthening university – labor market cooperation in the joint development of students' digital competences.

METHODS

The data for the analysis were collected through a sociological survey of university graduates in Ukraine under the age of 35 (a demographic group whose careers are most strongly shaped by the use of digital technologies) with at least one year of professional experience. Only graduates with work experience were included in the survey, thereby ensuring their ability to assess the relevance of their digital competences.

The methodological basis of the study was the DigComp2.2 (Vuorikari et al., 2022), which serves as the primary reference document for assessing digital competences within the EU. According to DigComp2.2 scale, each competence is evaluated on a 8-point scale, ranging from the lowest level of proficiency (1 point) to the highest level (8 points, confident user).

The questionnaire was developed in June – July 2024, followed by a pilot survey in August involving 32 resondents from the target group – university graduates under 35 years of age with work experience. The questionnaire was refined based on participants' feedback.

The main survey was conducted in September – October 2024 and included 397 respondents, covering all regions of Ukraine as well as graduates residing in EU countries. Data collection relied on professional university networks: academic staff maintaining contact with alumni and staff of quality assurance departments that regularly conduct alumni surveys.

For the calculation of the confidence interval, the actual sample parameters were used: Confidence Level – 95%, Population Proportion – 50%, Population Size – 9.9 million (based on statistical data on the number of young people in Ukraine as of the end of 2021, since population statistics have not been published since early 2022). Under these conditions, the margin of error is 4.92%, which allows the survey results to be considered reliable.

In addition, the internal consistency of the survey scale was assessed using the Cronbach's alpha (α coefficient), with interpretation thresholds as follows: 0,0-0,20 - Less Reliable; >0.20 – 0.40 - Rather Reliable; >0.40 – 0.60 - Quite Reliable; >0.60 – 0.80 – Reliable; >0.80 – 1.00 - Very Reliable (Ahdika, 2017). In the present study, the overall Cronbach's alpha was 0.98, indicating a high level of consistency and data reliability.

For the RQ2 analysis, respondents were grouped acciording to employment status: non-managerial employee, middle manager, top manager, self-employed, and unemployed. For the RQ3 analysis, respondents were grouped by monthly income (reflecting current labor market conditions in Ukraine at the time of the survey): from UAH 10,000 up to more than UAH 30,000, in increments of UAH 5,000. Comparisons were made relative to the highest income group (over UAH 30,000). The data were processed using IBM Statistical Package for the Social Sciences (SPSS), version 20.

RESULTS

Examining ***RQ1*** revealed that university education plays a more decisive role in the development of graduates' digital competences than individual efforts to improve digital skills after graduation. The most substantial increase in competences occurs during the period from university entry to gdaduation, while subsequent growth following the completion of formal education is moderate (Table 1).

At the same time, the post-graduation increase in indicators highlights the necessity of continuing independent digital skills development within professional contexts and provides further evidence of their significance for career advancement.

The self-assessment results of young people's digital competences reveal substantial differences in skill levels across various stages of professional development. At the time of university entry, the average level of digital competences was rated at 3.96 points on an eight-point scale; by graduation, this figure had increased to 5.82 points. These findings indicate a gradual yet consistent improvement in digital literacy, though the pace of growth varies depending on the specific dimensions of digital competences.

The most significant increase in digital skills occurs during university studies. The average growth during this period amounts to 1.17 points, which is considerable relative to the respondents' overall average competence level. The largest improvement was observed in Evaluating data, information and digital content (+1.62 points), underscoring the acquisition of critial thinking and analytical evaluation skills that are essential in today's information society. Marked improvements were also recorded in such categories as Collaborating in digital

environemnts (+1.41 points), Data management (+1.50 points), and Engaging in citizenship through digital technologies (+1.28 points). These findings highlight the particularly important role of universites in developing competences within the areas of Information and data literacy, Communication and collaboration.

Table 1. Growth of digital competences during university studies and in the workplace.

		At university entry	At graduation	At present	Increase during university studies	Increase in the workplace
C1	**INFORMATION AND DATA LITERACY**					
C1.1	Browsing, searching and filtering data, information and digital content	4,42	5,86	6,49	1,43	0,63
C1.2	Evaluating data, information and digital content	4,05	5,66	6,33	1,62	0,67
C1.3	Managing data, information and digital content	4,05	5,55	6,25	1,50	0,70
C2	**COMMUNICATION AND COLLABORATION**					
C2.1	Interacting through digital technologies	4,53	5,68	6,31	1,15	0,62
C2.2	Sharing through digital technologies	4,70	5,77	6,45	1,07	0,68
C2.3	Engaging in citizenship through digital technologies	3,90	5,18	6,08	1,28	0,90
C2.4	Collaborating through digital technologies	3,97	5,38	6,06	1,41	0,69
C2.5	Netiquette	4,33	5,54	6,17	1,21	0,63
C2.6	Managing digital identity	4,09	5,29	6,07	1,20	0,78
C3	**DIGITAL CONTENT CREATION**					
C3.1	Developing digital content	3,88	5,00	5,81	1,12	0,81
C3.2	Integrating and re-elaborating digital content	3,96	5,06	5,69	1,09	0,64
C3.3	Copyright and licences	3,51	4,67	5,38	1,16	0,71
C3.4	Programming	2,37	3,24	3,72	0,88	0,48
C4	**SAFETY**					
C4.1	Protecting devices	3,81	4,82	5,50	1,01	0,68
C4.2	Protecting personal data and privacy	4,17	5,16	5,83	0,98	0,67
C4.3	Protecting health and well-being	4,11	5,03	5,60	0,92	0,57
C4.4	Protecting the environment	3,96	5,05	5,69	1,10	0,64
C5	**PROBLEM SOLVING**					
C5.1	Solving technical problems	3,94	4,94	5,65	0,99	0,71
C5.2	Identifying needs and technological responses	4,04	5,15	5,82	1,12	0,67
C5.3	Creatively using digital technologies	3,80	4,93	5,73	1,13	0,80
C5.4	Identifying digital competence gaps	3,60	4,80	5,50	1,19	0,71
	Mean	*3,96*	*5,13*	*5,82*	*1,17*	*0,69*

Note: Grey shading indicates above-average skill growth at the corresponding stage of professiional development

Following graduation, growth in digital competences at the worklplace is less pronounced, averaging 0.69 points. This suggests that in professional settings, young people primarily apply already acquired skills, while the process of active acquisition of new digital competences slows considerably.

The most notable workplace-related improvements are observed in Engaging in citizenship through digital technologies (+0.90 points), Creating digital content (+0.81 points), and Creative use of digital technologies (+0.80 points, reflecting the most relevant areas of practical digital skills application.

Analysis of individual digital competences also reveals persistant challenges and gaps. Progarmming consistently demonstrates the lowest ratings across all three stages (at entry, graduation, and at present), ranging from 2.37 to 3.72 points, with minimal workplace-related growth. This suggests insufficient attention to algorithmic thinking and technical aspects of digital literacy, despite the fact that not all competences in this domain are limited to highly technical knowledge, such as programming code development. At the same time, this relatively low level should not necessarily be interpreted negatively. In assessing the impact of digital competences on career success, the focus of this study was on identifying *universal* skills. Programming, by contrast, constitutes a more *hard* skill, typical of IT-oriented professionals, and thus reflects only one segment of the labor market.

Overall, the analysis of self-assessment results demonstrates a generally positive dynamic in the growth of young people's digital literacy, with the most intensive development occuring during university studies. However, after graduation, the pace of improvement decreases significantly, while certain areas (such as programming) remain at a consistently low level.

Within ***RQ2***, the analysis was conducted with respect to respondent' career positions, allowing for an assessment of how digital competence levels affect professional status and employability. For this purpose, only results considered sufficiently reliable – i.e., those with Chi-Square Tests $p < 0.05$ – were included in the analysis (Table 2).

The findings show that the most successful group – top managers – exhibit particularly pronounced differences in the development of competences such as Evaluating data, information and digital content; Interacting through digital technologies; Collaborating through digital technologies; Netiquette; Copyright and licences; Creatively using digital technologies; Protecting health and well-being; Protecting the environment. This suggests that for a modern executive, it is especially important to work with large volumes of information, make strategic decisions on this basis, and effectively use digital tools to organize business processes – particularly communication – while also being sufficiently responsible to understand the impact of technology on health (both their own and that of employees) and on the environment. Another important conclusion is that a modern executive must be a highly skilled digital technology user: in eight out of the fourteen competences analyzed in Table 2 (those with results meeting the threshold of $p < 0.05$), the manager group significantly outperforms all other respondent groups.

Middle managers demonstrate considearbly lower digital competence scores compared to top managers. The largest gaps are observed in the areas of digital collaboration, digital identity management, and knowledge of copyright. This suggests that even minor deficits in digital competences can hinder career advancement.

Table 2. Average ratings of digital competences across professional groups of university graduates.

Competence		Chi-Square Tests		Average competence ratings by professional position				
		Value	Asymp. Sig. (2-sided)	Non-managerial employee	Middle manager	Top manager	Self-employed	Unemployed
C1.1	Browsing, searching and filtering data, information and digital content	51,007	0,005	6,83	6,10	7,00	6,26	7,00
C1.2	Evaluating data, information and digital content	61,602	0,000	6,65	6,01	6,67	6,10	6,20
C1.3	Managing data, information and digital content	57,715	0,001	6,55	5,92	6,44	6,14	6,00
C2.1	Interacting through digital technologies	46,950	0,014	6,62	5,95	6,78	6,12	6,40
C2.2	Sharing through digital technologies	51,852	0,004	6,76	6,10	6,59	6,36	6,80
C2.4	Collaborating through digital technologies	52,465	0,003	6,43	5,63	6,44	5,95	5,80
C2.5	Netiquette	41,415	0,049	6,45	5,83	6,56	6,09	6,20
C2.6	Managing digital identity	56,894	0,001	6,39	5,73	6,30	5,91	6,40
C3.3	Copyright and licences	41,395	0,049	5,71	5,02	5,81	5,14	5,40
C3.4	Programming	44,058	0,027	3,96	3,62	4,19	3,03	4,60
C4.3	Protecting health and well-being	66,983	0,000	5,96	5,34	6,11	4,98	6,00
C4.4	Protecting the environment	45,126	0,021	6,03	5,29	6,15	5,53	5,80
C5.3	Creatively using digital technologies	43,294	0,033	6,10	5,20	6,56	5,67	5,80
C5.4	Identifying digital competence gaps	74,762	0,000	5,27	5,83	4,78	5,64	5,60

Note: Grey shading indicates values in the top manager group that exceed the digital competence levels of all four other respondents groups.

Unemployed respondents demonstrate relatively high levels of digital competences, particularly in digital interaction, data analysis, and programming. However, their skills in digital collaboration and information management are less developed, which may impede employment opportunities, especially in teams working within digital environments. This indicates that while digital skills are crucial for labor market competitiveness, technical knowledge alone is insufficient – communication and organizational skills are equally important.

Self-employed individuals show average levels of digital competences, especially in the creative use of digital technologies. However, their lower scores in programming and digital security may limit opportunities for business growth and the adoption of cutting-edge technologies. This highlights the importance of digital competences not only for career advancement within organizations but also for entrepreneurship and competitiveness in the market.

Young people in non-managerial positions exhibit fairly high levels of digital competences, particularly in digital interaction, information evaluation, and data exchange. In the meantime, their programming skills remain lower, which may restrict career growth in fields requiring advanced technical expertise. This suggests that for young professionals, career advancemnt requires expanding competences in programming, digital securitty, and data management.

The analysis of differences in digital competences across groups with varying income levels, conducted within ***RQ2***, is presented in Table 3.

Table 3. Average ratings of digital competences and deviations from the highest-income group.

	Competence	Overall mean score	Mean (highest-income group)	Deviation
C1.1	Browsing, searching and filtering data, information and digital content	6,49	6,43	-0,06
C1.2	Evaluating data, information and digital content	6,33	6,39	0,06
C1.3	Managing data, information and digital content	6,25	6,25	0,00
C2.1	Interacting through digital technologies	6,31	6,24	-0,07
C2.2	Sharing through digital technologies	6,45	6,41	-0,04
C2.3	Engaging in citizenship through digital technologies	6,08	6,07	-0,01
C2.4	Collaborating through digital technologies	6,06	6,07	0,01
C2.5	Netiquette	6,17	6,19	0,02
C2.6	Managing digital identity	6,07	6,01	-0,06
C3.1	Developing digital content	5,81	5,84	0,03
C3.2	Integrating and re-elaborating digital content	5,69	5,77	0,07
C3.3	Copyright and licences	5,38	5,47	0,10
C3.4	Programming	3,72	4,01	0,28
C4.1	Protecting devices	5,50	5,68	0,17
C4.2	Protecting personal data and privacy	5,83	5,93	0,10
C4.3	Protecting health and well-being	5,60	5,60	0,00
C4.4	Protecting the environment	5,69	5,86	0,16
C5.1	Solving technical problems	5,65	5,79	0,14
C5.2	Identifying needs and technological responses	5,82	5,92	0,10
C5.3	Creatively using digital technologies	5,73	5,76	0,03
C5.4	Identifying digital competence gaps	5,50	5,73	0,23

As Table 3 demonstrates, respondents with the highest incomes possess the most advanced digital competences in the areas of Copyright and licences, Protecting devices, Protecting personal data and privacy, Protecting the environment, Solving technical problems, Identifying needs and technological responses, Identifying digital competence gaps. A particularly noticeable gap is also observed in Programming. However, a more detailed analysis of the primary data confirms that this finding applies mainly to IT specialists and therefore should not be generalized to the overall sampling.

DISCUSSION

Digital competences are a critical component of professional success. Employers place significant emphasis on their development, explicitly including them in job descriptions – indeed, in the post-pandamic new normal, digital skills have become a standard requirement (Roshchyk et al., 2024). Offering multiple advantages at both the individual and organizational levels, digital skills represent an important subject of scientific and applied research. However, the current discourse tends to focus on broad classifications of comptenece groups, often without linking them to career-related differences.

Against this background, our study provides a new perspective – identifying those digital competences that most strongly contribute to professional success in the form of career

advancement and higher incomes, as well as examining the role of universities in fostering the digital competences necessary for such success.

The findings within ***RQ1*** confirm that university education is a key factor in the development of digital competences. Kupchyk et al. (2025) claim that a university environment characterized by technological advancement, institutional support, and continuous teacher development creates "a sustainable and effective learning environment" (p. 24) designed to foster students' digital competences "through all subjects when organizing the curriculum space" (p. 3). Thus, the greatest increase in competences occurs during studies, whereas skill improvement in professional settings progresses more slowly. The role of university education outweighs that of skill enhancement gained in the workplace. This aligns with the conclusions of Morgan et al. (2022) regading the decisive role of formal education, though it contrasts with the findings of Arnold et al. (2016), who emphasized the predominance of continuous learning in the workplace. And Ukrainian universities remain a fundamental platform for the digital socialization of youth, a fact of particular importance in the context of the war-driven transition to remote and hybrid employment.

A comparison of graduates with different levels of career achievement (***RQ2***) shows that top managers exhibit significantly higher results in key universal digital competences – information evaluation, digital interaction, collaboration, netiquette, copyright, and creative use of technologies. Similar conclusions were reached by Periáñez-Cañadillas et al. (2019), who demonstrated that communication and analytical skills are essential in determining job candidates' professional suitability. Our findings further indicate that top managers overall demonstrate considerably higher average levels of digital competences. These results highlight the necessity of continuous competence development through digital technologies for those aiming at career growth. Hard skills alone are no longer sufficient to realize career ambtions, while their formation increasingly depends on mastery of digital competence.

In addressing ***RQ3***, we established that respondents with the highest incomes are characterized by stronger competences in security, technical problem-solving, data protection, and intellectual property protection. This is consistent with the findings of Wang et al. (2023), who emphasized the positive influence of digital competences on income levels and employability. In the meantime, our data diverge partially from Straubhaar et al. (2012), who questioned the direct link between digital competences and professional success. While we did not examine mathematical causalities, our comparative analysis confirmed the tendency for individuals with higher digital competences to achieve higher incomes. These results cannot be attributed solely to the impact of the war in Ukraine. First, the majority of respondents acquired their university-based digital skills prior to the war. Second, the large-scale transition to remote employment equalized opportunities for obtaining high incomes. However, it was those respondents who invested significantly in developing their digital competences who were best positioned to capitalize on these opportunities.

Overall, our results are in line with international researches (Livingstone et al., 2023; Tinmaz et al., 2022), which underline the role of universal digital competences in professional careers. Meanwhile, the weaker development of certain digital competences during university studies translates over time into shortages of competences critical for filling vacancies (Manana & Mawela, 2022). The identified gaps in formal education should serve as a signal for universities to improve curricula, with greater emphasis on the active use of digital technologies.

CONCLUSIONS

In this study, we tested for the first time the applicability of the Digital Competence Framework DigComp2.2 to assess the impact of each of the 21 digital competences defined in the framework on professional careers – measured in terms of employment status and income levels. Although professional success may require various hard skills, we identified a set of essential digital competences that, in the context of rapid technological development, clearly influence career achievement. In particular, the competences that should be developed irrespective of occupation or other factors include: Evaluating data, information and digital content; Collaborating through digital technologies; Netiquette; Copyright and licences; Protecting the environment; Creatively using digital technologies. These competences are most strongly developed among respondents who hold managerial positions and enjoy the highest incomes. At present, universities play a critical role in shaping the majority of these digital competences. Of course, the pace of technological change may significantly alter these patterns in the near future. Nevertheless, for higher education graduates who currently form the labor supply, these dependencies are evident and should be considered in the improvement of university curricula by institutions aiming to remain competitive providers of contemporary educational services.

Naturally, our study has certain *limitations*. These include challenges in accounting for differences in career outcomes across professional groups and the influence of demographic factors. Such an investigation requires a large-scale study with a broader sample across professions and occupational sectors in order to better understand the role of digital competences in career trajectories. This was not the objective of our study. Instead, our analysis identified universal skills – competences typical across professions and career stages – whose development can substantially enhance professional growth..

IMPLICATIONS FOR APPLICATION AND POLICY

The practical significance of the study lies in the potential use of its findings to improve university curricula, with particular emphasis on employing digital technologies to develop critical thinking, data literacy, and digital communication. Periodic monitoring of changes in graduates' digital competences – based on the approach presented here or its refinements – can drive qualitative improvements in training content. Such monitoring would be especially valuable at the national level, involving labor market stakeholders, relevant government bodies, and educational service providers, to ensure that the results inform educational policy

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