SILESIAN UNIVERSITY OF TECHNOLOGY PUBLISHING HOUSE

SCIENTIFIC PAPERS OF SILESIAN UNIVERSITY OF TECHNOLOGY 2022
ORGANIZATION AND MANAGEMENT SERIES NO. 159

DIGITAL COMPETENCES OF GENERATION Z IN THE AREA OF WORK AND PROFESSIONAL DEVELOPMENT

Elżbieta KOWALCZYK

Poznań University of Economics and Business; e.kowalczyk@ue.poznan.pl, ORCID: 0000-0003-4611-2246

Purpose: The aim of the paper is to elaborate the structure of the concept of functional digital competences for young adults in the area of work and professional development, and to develop a tool for measuring it.
Design/methodology/approach: Based on theoretical assumptions (Klimczuk et al., 2015; Nikodemska, 2016; Tarkowski et al., 2015) as well as empirical verification, the author elaborated a five-factor model of digital competences and a special questionnaire for measuring this concept was prepared. Author used such statistic methods as the EFA, the CFA, the Mann-Whitney U test, the Student's t-test for independent samples, the Spearman's rho correlation.
Findings: The elaborated tool and model was validated and, in the majority, the socio-demographic factors (such: age, gender, education level, employability) affecting functional digital competencies were also statistically significant.
Research limitations: the study include a relatively small research sample as well as its geographic scope was narrow – the research was conducted at a university of economics in Poland among a group where the school-to-work transition occurs smoothly, and the periods of education and work often overlap. The findings could also be affected by the situation related to the Covid-19 pandemic and the resulting major shift of the entire society to online activity.
Practical implication: The results show the areas of competency deficiencies in Polish Z generation and could help, by special developing programmes, make them more competitive on the European young people's labour market.
Social implication: The development of a society's digital competences is crucial because in an information society they are the ticket to a successful career and a comfortable, high-quality life.
Originality/value: The paper presents the new model and a dedicated measuring tool to assess digital competences of generation Z in the area of work and professional development. It's addressed to educators, employers, and specialists elaborating programme of society's digitalization.

Keywords: digital competencies, generation Z, digital competence measurement, gender, age, education level.

Category of the paper: Research paper.

1. Introduction

A digital transformation towards an information society and Industry 4.0 (IOT) requires an increase in access to information and communication technologies (ICT) and in the level of digital competences. Ferrari understands digital competences as a set of the knowledge, skills, abilities, strategies and awareness necessary to use ICT and digital media. Thanks these people can – effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively – manage information, evaluate and solve problems, communicate, collaborate, create and share content. Such they can participate in different life areas, learn new things and feel socialized (Ferrari, 2012).

It is estimated that digital competences are required in as much as 90% of professional work. In this context it is concerning to learn that in 2019 Poland was in 20th place in terms of the level of digital competences among its citizens (out of 29 countries included in the study), with the findings showing that just under 50% of Polish citizens possessed them at least at a basic level (Digital Skills for All European, 2019). In the Digital Economy and Society Index (Digital Economy and Society Index (DESI) 2020. Human Capital, 2020) study, Poles achieved results slightly above the EU average only in terms of Connectivity, and below the EU average in all the other DESI 2020 aspects: such as Human Capital, Citizen Internet Use, Business Technology Integration, and Public Service (Digital Economy and Society Index (DESI) 2020. Human Capital, 2020).

2. The concept of digital competences

Digital competences are a set of interdependent skills. At the core are computer competences: which include the ability to use software, mobile applications or ICT devices (e.g. using touch screens, using a computer mouse, using computer keyboard shortcuts, solving technological problems); and the ability to create new digital content and knowledge while respecting copyrights and licenses (e.g. programming, creating multimedia files, posting) in order to express oneself creatively through digital media and technologies.

The next level is made up of information competences: which comprise searching databases; using search engines and verifying the obtained results; assessing the credibility of sources; the ability to break the filter bubble; safely sharing one's own knowledge and information about oneself; recording, playing, storing and sharing various file formats in a way that is safe for data and devices; and communicating by means of various technological solutions (Dąbrowska et al., 2015; Ferrari, Punie, and Brečko, 2013; Klimczuk et al., 2015; Tarkowski et al., 2015). At the same time, people make use of digital competences in order to

successfully achieve goals which are important to them, including effective functioning in the labour market. Empirical research shows that both students and employers acknowledge a connection between digital competences and employability. This is additionally strengthened by a high level of education and health habits (Pirzada, Khan, 2013).

3. Methods of measuring digital competences

Measuring digital competences is connected with many difficulties, which result from the rapid development of information and communication technologies leading to the obsolescence of many methods (e.g. assessing digital competences based on the attitude to ATMs (Sinkovics et al., 2002); significant social stratification in terms of competences (e.g. methods developed for people 50+ (Tarkowski et al., 2015); as well as a large variety of concepts and models of competences. One of the more universal approaches is the Technology Readiness Index (TRI) measurement, which assesses the overall degree of technology acceptance (Godoe, Johansen, 2012). Another issue is the method of measurement, generally based on self-assessment rating scales.

Recognizing the great importance of these competences for career development, the European Commission commissioned a tool for measuring digital skills. It assesses such areas as Information and data literacy, Communication and collaboration, Digital content creation, Safety, and Problem solving (Digital Skills Assessment Tool, n.d.).

4. Generation Z with student status

Generation Z is also named the I-generation, net-gen, or digital natives. People belonging to this generation were born in the mid-1990s through the late 2010s. They do not know a world without computers, tablets, smartphones, other devices and the Internet (Turner, 2015). They have a considerable ability to multi-task at work while being more productive than the earlier generation Y, which is related with their broad access to information and social networks. Research shows that people belonging to this generation are highly self-confident, optimistic about their career prospects, and tend to show entrepreneurial initiative. They prefer to work independently and are reluctant to stick to timetables. Interestingly, despite their involvement in social media, they are less committed to civic engagement (Iorgulescu, 2016). Polish young adults from generation Z were born after the change of the political system and during Poland's accession to the EU. In the academic year 2020/2021 in Poland 1 055 617 people up to 27 years of age were students at higher education institutions (Adamska et al., 2021). They achieved the

European average level in terms of such digital competences as information and communication skills, but in other dimensions their results are worse. Nevertheless, in Polish society they are the group with the highest level of digital competences, which gives them an advantage over other participants in the domestic labour market (Table 1). The position of young people who are in the school-to-work transition period and their smooth transition between the two spheres has never been easy, but digital competences can greatly assist this process (Brzinsky-Fay, 2014).

5. Determinants of digital competence levels

Education quality. In 2012, 15-year-old respondents from generation Z in OECD countries were surveyed with the Survey of Adult Skills (Education GPS - Poland - Adult Skills (Survey of Adult Skills), 2012). In this survey 54.9 % of young people (15 years old) in OECD countries and 66.4% in Poland browsed the internet for schoolwork outside of school at least once a week, and spent 104 minutes on weekdays and spent 117 minutes at weekends. On average 31.66% students in OECD countries and 25.3% in Poland reported the use of computers in mathematics lessons during the month prior to the PISA test. 72% students in all OECD countries and only 60.3% in Poland used computers at school. It is significant that although at that time Polish students' scores were below the OECD average level in terms of performance in digital reading and computer-based mathematics, young Poles saw themselves as employees in the ICT area 5 times more often than the average result for OECD countries ("Education GPS - Poland - Adult skills (Survey of Adult Skills)", 2012). Between 2012 and 2019 access to the Internet on a global scale increased by almost 19% (Measuring Digital Development. Facts and Figures, 2019), which had an impact on the level of societies' digital competences. However, the digital competences of Poles did not improve sufficiently to equal or exceed the average results for the EU (see Table 1).

Sociodemographic factors (gender and age). The findings of the Eurostat survey for 2019 are presented in Table 1, and they show that competence shortages among the young generation in Poland are related to areas demanding specialist technological knowledge and the ability to solve problems.

Gender-based differences in using the Internet, which generally put men in a privileged position, are also an important issue. Data from the International Telecommunication Union (Measuring Digital Development. Facts and Figures 2019, 2019)(ITU, a United Nations agency) for 2015 and 2019 show that the gender gap regarding the use of this medium decreased in Europe and the group of developed countries, while, worryingly, it increased in other regions of the world and in the group of developing countries. The predominance of women as Internet users was recorded in only eight countries (including two European countries – Sweden and

Ireland), and a state of relative equilibrium was observed in slightly more than a quarter of the countries (including Poland). In most European countries it is predominantly men that use the Internet (Measuring Digital Development. Facts and Figures 2019, 2019).

However, in the group of young people from Generation Z (aged 19-24), both in Poland and the EU, no clear gender differences were noted, while in Finland young women are much better in terms of software skills and overall digital skills (Individuals' Level of Digital Skills, 2020). Thus, these findings debunk the myth about the natural advantage of men in this area. It is also worth noting that women with higher education degrees perform worse than men, especially with regard to problem solving skills, software skills and overall digital skills. Therefore, it is worth promoting these competences among women. Unfortunately, however, Poland was in last place in terms of the percentage of women participating in the 2019 Code Week (less than 40%, with the EU average at 47% and the best result, for Luxembourg, at 56%), a grassroots event organized in EU countries which promotes coding and digital skills (Digital Economy and Society Index (DESI) 2020). In terms of digital competences, Polish women occupy 23rd place in the ranking of the member states. The smallest gender gap in digital skills was recorded among people aged 16-24 years, while the largest in the area of specialist skills and employment as well as Internet users skills (Women in Digital Scoreboard 2020, 2020).

Table 1.
Factors determining the digital competences of the citizens of Poland and the EU

Poland and EU	Selected factors		The level of digital skills of individuals in 2019 [in %]				
			Information	**Communication**	**Problem solving**	**Software**	**Overall digital skills**
Poland	General		10^b / 62^c	15^b / 58^c	23^b / 47^c	20^b / 27^c	15^a / 23^b /21^c
	19-24 y	General	9^b / 82	5/ 94	22 /80	19/ 70	19 / 32 / 48
		Males	14^b / 82	5 / 91	21/ 75	19 / 63	18 / 32 / 49
		Females	13^b / 82	5 /94	22 / 74	20 / 61	20 / 32 / 47
	Students		11^b / 85	4 / 95	20 / 77	14 / 75	12 / 30 / 56
	Active labour force		14^b / 71	17 / 67	24 / 57	24 / 30	37 / 28 / 25
UE 28	General		13^b / 71	16 / 67	19 / 59	19 / 41	28 / 25 /33
	19-24 y	General	13^b/85	6/ 91	14 / 95	15/ 82	16 / 23 / 59
		Males	10^b / 84	6 / 93	14 / 81	14 / 70	16 / 22 / 60
		Females	8^b / 85	5 / 91	15 / 80	15 / 70	15 / 23 / 59
	Students		8^b / 86	6 / 91	14 / 82	10 / 80	11 / 21 / 66
	Active labour force		9^b / 79	16 / 74	18 /68	21 / 47	27 / 28 / 39

Note: low[a] / basic[b] / above basic[c]

Source: (*Individuals' Level of Digital Skills*, 2020).

Employment status. Also, the level of digital competences among the active labour force (employed and unemployed) in Poland is much lower than the EU average, which makes Poles less competitive under the conditions of Industry 4.0. European data show that the competences of economically active people are higher than those of the entire analysed society, which may indicate that the labour market stimulates their development.

6. Problems and hypotheses

Focusing the attention of this research on the functional digital competences in the area of work and the professional career of students who represented generation Z, the following research questions were formulated, to which answers were sought through empirical research:

- what is the structure of the model describing functional digital competences in the areas of work and professional development of student's from generation Z?,
- do the high education levels and socio-demographic factors determine the levels of the elaborated model dimensions?

The following hypotheses were also formulated:

H1 Functional digital competences in the sphere of work and professional development are a multifactorial construct.

H2 The levels of functional digital competences in the sphere of work and professional development are determined by gender.

H3 The levels of functional digital competences in the sphere of work and professional development are determined by the level of studies.

H4 The levels of functional digital competences in the sphere of work and professional development are determined by age.

H5 The levels of functional digital competences in the sphere of work and professional development are determined by employment status.

7. Research tool

In order to construct a tool for the assessment of students' functional digital competences, based on an analysis of numerous sources as well as statements and opinions of students at various levels of education, 53 items were generated which examine the use of various types of ICT-based solutions aimed at improving the position of individuals in the labour market and their career development. The initial assumption of the test structure was modelled on the concept presented in *Ramowy katalog kompetencji cyfrowych* [Framework Directory of Digital Competences] (Klimczuk et al., 2015), which lists 6 spheres of digital activity in the area of "labour market and professional development". The respondents made a self-assessment of their competences, responding to each of the test items on a 5-point forced-choice assessment scale (Brzezińska and Brzeziński, 2006), in which the division shown in the legend to Figure 2 was adopted.

At the initial stages of data evaluation, some items were excluded from further analyses due to variance <1 and high values of skewness and kurtosis, indicating a significant deviation from the normal distribution (George and Mallery, 2016). Based on the evaluation of the scree plot (Figure 1) and following the results of exploratory factor analysis (EFA) using the maximum likelihood factor extraction technique, their number was specified, and the model matrix was achieved in 6 iterations.

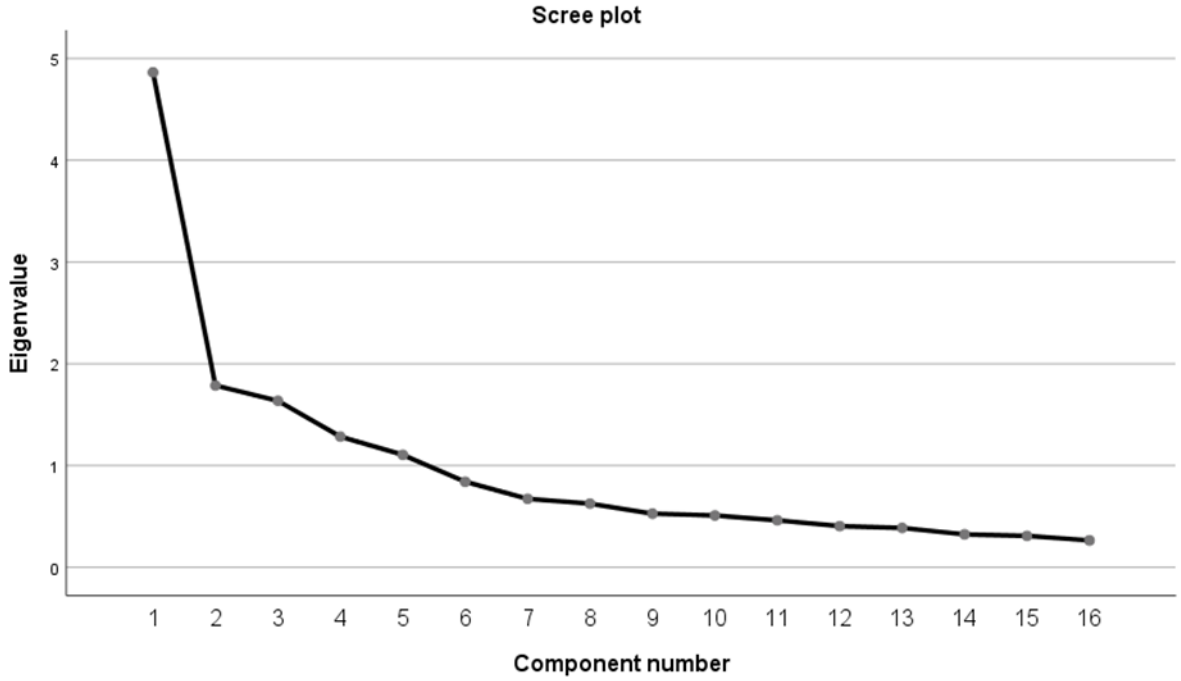

Figure 1. Scree plot: factors in the competence measurement questionnaire. Source: author's own study

The factors *Job Seeking* and *Work Efficiency and Comfort* consists of 4 items each and Cronbach's alpha reliability coefficient for these factors were 0.755. and 0.752 The factors called *Professional Development and International Education* and *Professional Development and Digital Education* consists of 3 items each (Cronbach's alpha reliability coefficient were 0.826 and0.732) The final factor called *Economic Relations with Public Administration* is consisting of two items and it's Cronbach's alpha reliability coefficient was 0.775). Reliability for the entire scale is expressed by McDonald's $\omega = 0.846$ and the exclusion of subsequent items did not increase this value. The scale variance explains 66.72% of the variability of the tested construct. In the further studies, on a sample of 900 respondents, confirmatory factor analysis (CFA) was conducted in which it was found that that the originally assumed model was well fitted to the data, $\chi 2$ (94) = 322.00; $p < 0.001$; CFI = 0.965; TLI = 0.955; SRMR = 0.040; RMSEA = 0.051 (90% CI [0.045; 0.057]). Therefore, hypothesis 1 was confirmed.

8. Research sample

In total, 242 respondents took part in the study, of which 139 (57.4%) were women and 103 (42.6%) men. The group included 108 (44.6%) undergraduate students (first cycle), 120 (49.6%) graduate students (second cycle), 7 (2.9%) doctoral students (third cycle), and 7 (2.9%) participants who gave other responses. The mean age of the respondents was 23.88 years (SD=3.028), and the median value was 23. The study employed the CAWI method, using Google Forms. The research was conducted at one of the Polish public economics and business universities.

As regards the areas of occupational activity in the labour market, it was found that 200 (82.6%) of the surveyed people had been in employment, and 224 (92.6%) had made efforts to make their jobs more comfortable and efficient. As many as 226 (93.4%) respondents had looked for a job, and 220 (91.9%) had raised their qualifications. On the other hand, 91 (37.6%) people had undertaken actions aimed at protecting their rights related to work and professional career, only 36 (14.9%) had started and/or ran a business, and 17 (7%) were employed people. The full range of answers obtained on the basis of a 5-point forced-choice scale is shown in Figure 2.

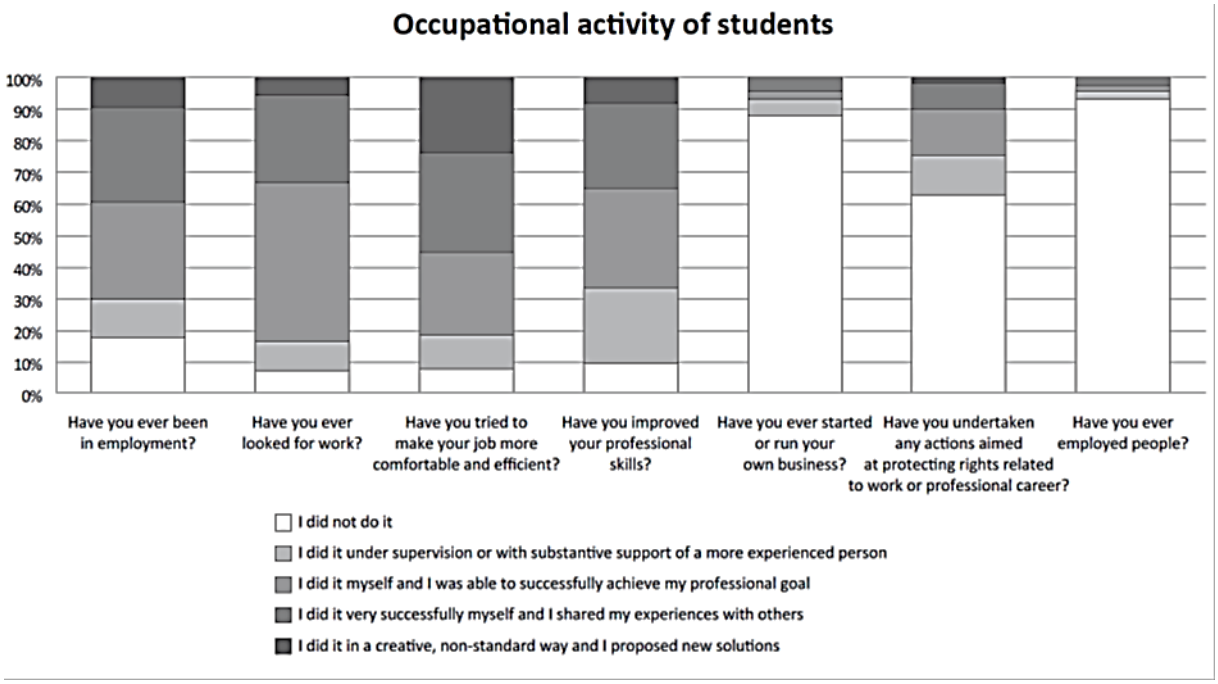

Figure 2. The activity of students with respect to work and professional development. Source: author's own study.

Additionally, the respondents declared their current status in the labour market. It can be concluded that the students are active with regard to their occupations and the development of their careers.

9. Levels of digital competences among Polish students from Z generation

Gender and digital competences. In order to compare men and women in terms of the analysed factors, an analysis was performed using Student's t-test for independent samples. The analysis showed significant differences between the groups in relation to *Professional Development and International Education*, *Professional Development and Digital Education* and *Economic Relations with Public Administration*. Men obtained significantly higher results for the above-mentioned factors in comparison to women. The effect size for the differences ranged from weak to moderate. No differences between the genders were observed for *Job Seeking* and *Work Efficiency and Comfort* (Table 2). Therefore, it can be concluded that hypothesis 2 was confirmed.

Table 2.
Comparison of women and men in terms of the analysed competence areas – statistically significant results

Factors	Woman (n = 139)		Man (n = 103)		t	p	95% *CI*		Cohen's d
	M	***SD***	***M***	***SD***			*LL*	*UL*	
3. Professional Development and International Education	1.59	0.90	1.86	0.98	-2.25	**0.025**	-0.51	-0.03	0.29
4. Professional Development and Digital Education	2.38	1.02	2.67	0.96	-2.21	**0.028**	-0.54	-0.03	0.29
5. Economic Relations with Public Administration	2.11	1.13	2.67	1.21	-3.75	**0.000**	-0.86	-0.27	0.49

Source: author's own study.

First, second and third cycle students in relation to digital competences. Student's t-test analysis for independent samples showed significant differences between the compared groups for *Work Efficiency and Comfort* and *Economic Relations with Public Administration*. Graduate (second cycle) and doctoral (third cycle) students obtained higher results for these areas of competence compared to undergraduate (first cycle) students. The effect size for the differences was moderate (Table 3). Hypothesis 3 was thus confirmed.

Table 3.
Comparison of the analysed digital competence areas for first cycle students and second and third cycle students – statistically significant results

Factors	1st cycle (n = 108)		2nd and 3rd cycle (n = 134)		t	p	95% *CI*		Cohen's d
	M	*SD*	*M*	*SD*			*LL*	*UL*	
2.Work Efficiency and Comfort	2.09	0.89	2.46	0.90	-3.17	**0.002**	-0.60	-0.14	0.41
5. Economic Relations with Public Administration	2.04	1.11	2.60	1.20	-3.69	**<0.001**	-0.85	-0.26	0.48

Source: author's own study.

In addition to the above findings, Spearman's rho correlation was performed (which was dictated by skewness = 3.15 and kurtosis = 13.82 for the age distribution of the respondents), the purpose of which was to verify the relationship between the age of the respondents and the analysed areas of functional digital competences. The calculations showed that only the values concerning the area of *Professional Development and International Education* were unrelated to the respondents' age. For the remaining factors, a weak and positive correlation was noted, which means that the older the respondents were, the higher the results that they obtained in the remaining competence areas (Table 4). Therefore, hypothesis 4 was confirmed.

Table 4.
Spearman's correlations between age and digital competence areas - statistically significant results

Factors	age	
	r_s	p
1. Job Seeking	0.13	**0.038**
2.Work Efficiency and Comfort	0.19	**0.003**
4. Professional Development and Digital Education	0.14	**0.036**
5. Economic Relations with Public Administration	0.24	**0.000**

Source: author's own study.

Employment status and digital competences. In order to compare employed and unemployed people in terms of the analysed factors, the Mann-Whitney U test was performed. The analysis showed that those respondents who were employed obtained higher results for *Job Seeking*, *Work Efficiency and Comfort*, and *Professional Development and Digital Education* than those who were unemployed. The effect size for the differences was weak (Table 5). Hypothesis 5, however, cannot be considered to have been falsified.

Table 5.
Comparison of employed and unemployed people in terms of the analysed competence areas - statistically significant results

Factors	Unemployed (n = 64)			Employed (n = 178)			Z	p	r
	Mean rank	*Me*	*IQR*	Mean rank	*Me*	*IQR*			
1. Job Seeking	101.88	2.75	1.44	128.55	3.00	1.00	-2.63	**0.009**	0.17
2. Work Efficiency and Comfort	100.28	2.00	1.19	129.13	2.50	1.25	-2.85	**0.004**	0.18
4. Professional Development and Digital Education	99.47	2.00	1.67	129.42	2.33	1.33	-2.96	**0.003**	0.19

Source: author's own study.

10.Discussion and conclusions

The empirical research analysed a group of young adults from Z generation, and the measurement tool used in the study revealed deficits as regards the use of functional digital competences in the area of work and professional development. The data show that the students' main activity is focused on the areas of *Job Seeking, Professional Development and Digital Education*. Taking into account the gender factor and the even level of digital competences in this group ("Individuals' level of digital skills", 2020), it can be assumed that the reasons for the poorer performance of women as concerns these competences can be attributed to non-digital factors. A higher level of digital competences among young women in Finland may suggest that these factors include national culture, especially such dimensions of culture as the power distance index and masculinity versus femininity (Hofstede, Hofstede, and Minkov, 2011), which is reflected in the education and position of women in society as well as in stereotypes about women and their abilities. Moreover, research commissioned by the EU shows that despite the even level of competences between the genders, men tend to assess themselves higher in terms of the use of those competences in the sphere of work and public life, and in terms of benefits for education. This also applies to men involved with computer programming, 70% of whom assess their competences at least at the level of 7 on a 10-point scale. Women tend to be more cautious in their assessments, and this phenomenon is called a "confidence gap". Also, the entrepreneurship of Polish women may contribute to differences with respect to competences concerning *Economic Relations with Public Administration*; and their entrepreneurship, along with leadership and professional work, are the greatest challenges for women in society 4.0 (Quirós et al., 2018).

The results of the empirical research, which show an advantage at the level of competences related to the respondents' age and level of higher education, are consistent with the education-work transition stage at which students find themselves. The importance of being in employment also confirms the thesis that professional activity stimulates the development of digital competences since the results of those who were employed were higher in three dimensions.

Acknowledgments

The project financed within the Regional Initiative for Excellence programme of the Minister of Science and Higher Education of Poland, years 2019-2022, grant no. 004/RID/2018/19, financing 3,000,000 PLN.

References

1. Adamska, K., Grochowska-Subotowicz, E., Jabłoński, R., Leszczyński, A., Wiktor, M., & Zielińska, H. (2021). *Szkolnictwo wyższe i jego finanse w 2020 r. Higher education and its finances in 2020*. https://stat.gov.pl/obszary-tematyczne/edukacja/.
2. Brzezińska, A.I., & Brzeziński, J.M. (2006). Skale szacunkowe w badaniach diagnostycznych. In: J.M. Brzeziński (Ed.), *Metodologia badań psychologicznych. Wybór tekstów* (pp. 299-399). PWN.
3. Brzinsky-Fay, C. (2014). The Measurement of School-to-work Transitions as Processes About events and sequences. *European Societies*, *16*(2), 213-232. https://doi.org/10.1080/14616696.2013.821620.
4. Dąbrowska, A.J., Drzewiecki, P., Górecka, D., Gruhn, A., Hojnacki, L., Jasiewicz, J., Lipszyc, J., Majewski, W., Murawska-Najmiec, E., Stunża, G., Śliwowski, K., Tafiłowski, P., Wilkowski, M., & Woźniak, M. (2015). *Cyfrowa przyszłość. Katalog kompetencji medialnych i informacyjnych*. http://nowoczesnapolska.org.pl.
5. *Digital Economy and Society Index (DESI) 2020. Human capital* (2020). https://ec.europa.eu/digital-single-market/en/human-capital-and-digital-skills.
6. *Digital Economy and Society Index (DESI) 2020* (2020). https://ec.europa.eu/digital-single-market/en/digital-economy-and-society-index-desi.
7. *Digital Skills Assessment Tool* (n.d.). Retrieved from https://europa.eu/europass/digitalskills/screen/home, 23.04.2022
8. *Digital skills for all European* (2019). https://doi.org/10.2759/382111.

9. *Education GPS - Poland - Adult skills (Survey of Adult Skills)* (2012). PIAAC. https://gpseducation.oecd.org/CountryProfile?primaryCountry=POL&treshold=10&topic=AS.
10. Ferrari, A. (2012). *Digital Competence in Practice: An Analysis of Frameworks*. https://doi.org/10.2791/82116.
11. Ferrari, A., Punie, Y., & Brečko, B.N. (2013). *DIGCOMP: A Framework for Developing and Understanding Digital Competence in Europe*. https://doi.org/10.2788/52966.
12. George, D., & Mallery, P. (2016). *IBM SPSS statistics 23 step by step: A simple guide and reference*. Routledge. https://doi.org/10.4324/9781315545899.
13. Godoe, P., & Johansen, T.S. (2012). Understanding adoption of new technologies: Technology readiness and technology acceptance as an integrated concept. *Journal of European Psychology Students*, *3*, 38-52.
14. Hofstede, G., Hofstede, G.J., & Minkov, M. (2011). *Kultury i organizacje*. PWE.
15. *Individuals' level of digital skills* (2020, October 14). Eurostat. https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do.
16. Iorgulescu, M.-C. (2016). Generation Z and its perfection of work. *Cross-Cultural Management Journal* , *XVIII*(1), 47-54. https://www.seaopenresearch.eu/Journals/articles/CMJ2016_I1_6.pdf.
17. Klimczuk, A., Jasiewicz, J., Filiciak, M., Mierzecka, A., Śliwowski, K., Kisilowska, M., Tarkowski, A., & Zadrożny, J. (2015). *Ramowy katalog kompetencji cyfrowych*. https://doi.org/10.13140/RG.2.1.3402.4167.
18. *Measuring digital development. Facts and figures 2019* (2019). https://www.itu.int/en/myitu/Publications/2020/12/10/08/25/Measuring-Digital-Development-2019.
19. Nikodemska, S. (2016). *ABC kompetencji*. https://www.slideshare.net/emplocombezpatny-ebook-abc-kompetencji-50-stron-dla-eksperta-hr-2016-02-11.
20. Pirzada, K., & Khan, F. N. (2013). Measuring Relationship between Digital Skills and Employability. *European Journal of Business and Management*, *5*(24), 124-134. www.iiste.org.
21. Quirós, C.T., Morales, E.G., Pastor, R.R., Carmona, A.F., Ibáñez, M.S., & Herrera, U.M. (2018). *Women in the Digital Age*. https://doi.org/10.2759/526938.
22. Sinkovics, R.R., Stöttinger, B., Schlegelmilch, B.B., & Sundaresan, R. (2002). Reluctance to Use Technology- Related Products: Development of a Technophobia Scale. *Thunderbird International Business Review*, *44*(4), 477-494. https://doi.org/10.1002/tie.10033.
23. Tarkowski, A., Mierzecka, A., Jasiewicz, J., Filiciak, M., Kisilowska, Małgorzata Klimczuk, A., & Bojanowska, E. (2015). *Taksonomia funkcjonalnych kompetencji cyfrowych oraz metodologia pomiaru poziomu funkcjonalnych kompetencji cyfrowych osób z pokolenia 50+*. https://epale.ec.europa.eu/pl/resource-centre/content/taksonomia-funkcjonalnych-kompetencji-cyfrowych-oraz-metodologia-pomiaru.

24. Turner, A. (2015). Generation Z: Technology and Social Interest.: EBSCOhost. *Journal of Individual Psychology*, *71*(2), 103-113. https://web.s.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=0&sid=78e064b5-8c98-42b6-87ca-919b10528647%40redis.
25. *Women in Digital Scoreboard 2020* (2020). https://digital-strategy.ec.europa.eu/en/library/women-digital-scoreboard-2020.