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GRADUATE STUDENTS' ATTITUDES TO THE DEVELOPMENT OF DIGITAL OPPORTUNITIES AT THE LEVEL OF INDIVIDUALS AND EDUCATIONAL ORGANISATIONS

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Abstract: *The digital transformation of education requires the development of both individual digital capabilities, in particular, researchers, and the digital capabilities of higher education institutions. The article presents the design and results of a study of Ph.D. students' attitudes from Borys Grinchenko Kyiv University (Ukraine), University of Silesia (Poland), and Extremadura University (Spain) to digital opportunities at the individual level and the level of educational organisations. Following the self-assessment of postgraduate students, which was based on the relevant models and descriptors of the Jisc digital capabilities structure, the main factors influencing the development of the researcher's digital capabilities were determined. The major factor was the degree of influence of the organisational digital maturity of the universities where young researchers are trained. It was determined that graduate students, regardless of affiliation, the factors which have the greatest influence on the*

development of the researcher's digital capabilities include: the digital environment of the educational institution where graduate students study; competent teachers who have a high level of digital competence and successfully use it in teaching; collaboration with fellow graduate students or other researchers. The need for the development of Communications and Digital infrastructure as the elements of organisational digital capability has been identified. The obtained results can be used in the scaling of the proposed methodology, as well as in the design of digital environments of higher education institutions and the methodology of their application in the process of training specialists at a high level of digital capabilities.

Keywords: digital capabilities, organisational digital capabilities, higher education institution, Ph.D. students, survey.

INTRODUCTION

Due to the rapid pace of digital changes in various industries, organisations are forced to increase the pace of their digital transformations to create new or modify (digitalise) existing business processes, cultures and experiences to meet the demands of the labour market (Mhlungu et al., 2019). And, if for businesses the need and adoption of digital transformation is more a matter of survival, for educational organisations the implementation of digital technologies can help institutions become more competitive (Mohamed Hashim et al., 2022).

The report entitled "Driving Digital Transformation in Higher Education" (Brooks & McCormack, 2020) states that the digital transformation of an educational institution should be preceded by the digitization of existing information (1), which includes the digitisation and organisation of analogue materials, and the digitisation of processes (2), which involves their automation and optimisation. For this, digital capabilities should be taken into account and developed both at the individual level and the level of the institution (organization). Moreover, the digital capabilities of professionals are related not only to disciplinary or organisational innovations but also to economic competitiveness (Orlik, 2018).

We agree (Bartlett-Bragg, 2017) that the concept of "digital capabilities" is broader than the concept of digital competence, as it exists at the intersection of people and technology, work and learning. These are digital practices that people and organizations need for successful implementation in a digital society (Jisc 2017a). At the same time, modern studies focus on the formation of students' and teachers' individual digital capabilities (Limniou et al., 2021; Varga-Atkins, 2020; Balyk et al., 2020) as subjects of the educational process of higher education institutions. Somewhat less research interest has been shown in developing the digital capabilities of early career researchers and research teams (Kuzminska et al., 2021; Wolski et al., 2020), although the research potential of a higher education institution is important both for training specialists in modern digital society and the implementation of digital transformation. The developing of digital capabilities was discovered by some researchers from different countries. The professional development of digital competences as standardized frameworks supporting evolving digital badging practices

was researched by Kullaslahti, Ruhalahti, & Brauer (2019). The development of students' digital competence in teacher training studies as a Polish case was analysed by Nowak (2019) The experts from Mexico concluded that "based on the results, Ph.D. students do not exhibit a higher level of digital competencies simply because they are in this academic level, and their gender is not a determining factor either. Moreover, partial evidence was found in several dimensions (statistically significant relationships), which suggests that distance education programs foster digital competencies as opposed to blended learning (b-learning) programs." (Sanchez-Macias & Veytia-Bucheli, 2019). Simultaneously, there are only a few such types of research. Touching upon the lack of research devoted to studying the organisational digital capability of modern universities for the development of individual digital capabilities of their students, teachers, scientists and representatives of the administration (Jisc, 2017a), there is a need to determine the relationship between the individual digital capabilities of the subjects and the general level of digital transformation of an educational institution.

The purpose of this study is to investigate the attitude of young researchers, in particular Ph.D. students from different countries, to their digital capabilities and to determine influencing factors that will contribute to their development both at the individual level and at the level of digital transformation of an educational institution. The obtained results can be useful both to researchers in the field of educational sciences and to representatives of structural subdivisions of higher education institutions to take into account factors that, according to applicants of the third level of higher education, have a significant impact on the development of researchers' individual digital capabilities and the creation of conditions for their acquisition by graduate students. This target audience has been selected because graduate students are modern young researchers who belong to the digital generation. They need to use digital services and tools in various spheres of life, particularly in research and have a clear vision of the prospects for their development. They are interested in future career development. They are aware of self-improvement and lifelong learning.

To achieve the goals of our research, we formulated the following tasks:

1. Select groups of graduate students with a high level of readiness to develop their digital capabilities as researchers (experts) from three higher education institutions in Ukraine and EU countries; limit the factors that regulate the development of their digital competence and prove the homogeneity of these groups;
2. To determine graduate students' attitude regarding the conditions offered for organisational digital maturity at their universities, developing individual digital capabilities, and compare the opinions of young researchers in a few countries.

RESEARCH DESIGN

In our study, a selective statistical survey was used as one of the methods for monitoring and evaluating the effectiveness of the implementation of educational projects. The idea is to conduct an expert assessment to determine the factors affecting the

development of the researcher's digital capabilities in general and the components of organisational digital capability in particular. To formulate the questions in the questionnaire, we introduced the following basis:

- self-assessment of the level reflecting graduate students' digital capabilities – a researcher's profile as an element of the Jisc individual digital capabilities structure (https://digitalcapability.jisc.ac.uk/what-is-digital-capability), which focuses on the digital capabilities of the Jisc Researcher (Jisc, 2017b), relevant for young and experienced researchers of higher education;
- to determine the level of graduate students' satisfaction with the existing digital capability of the educational institution where the training is carried out – (see a model of the digitally capable organization by Jisc (Jisc, 2017c) and Jisc's organisational digital capabilities maturity model (Figure 1).

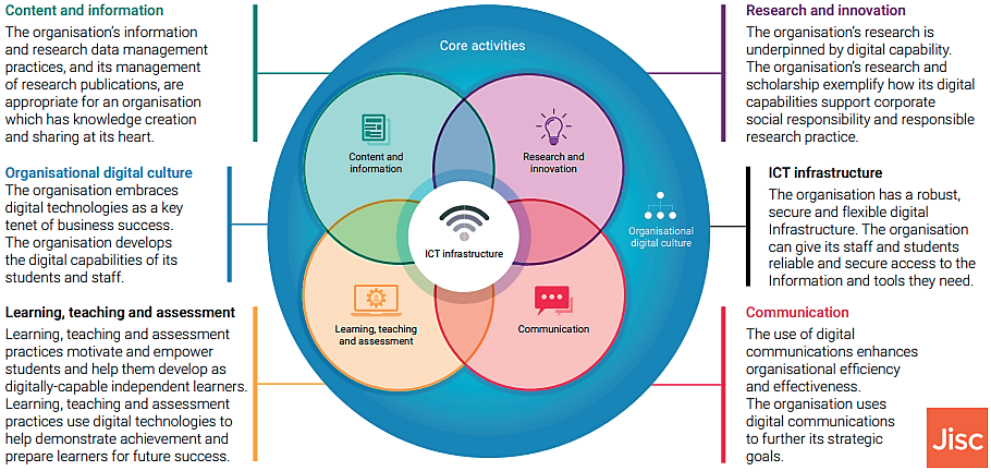


Figure 1. Jisc's organisational digital capabilities maturity model (Jisc 2017a, https://bdcdei-prod-media.s3.eu-west-1.amazonaws.com/documents/32755h2_JISC_BDC_OrganisationalMaturityModel_Inforgraphic.pdf)

Source: The figure is available on the CC BY-NC-SA Creative Commons License (https://digitalcapability.jisc.ac.uk/what-is-digital-capability/organisational-digital-capability/, https://bdcdei-prod-media.s3.eu-west-1.amazonaws.com/documents/32755h2_JISC_BDC_OrganisationalMaturityModel_Inforgraphic.pdf).

This study was conducted for the first time, we used the descriptors of the official profiles of researchers' digital capabilities and organisational digital capabilities of universities from the Jisc organisation. However, additional questions were used in the questionnaire, a further check was carried out and its reliability was confirmed: the internal consistency of the questionnaire was evaluated by Cronbach's alpha coefficient and the split-half method (Cronbach, 1951; Finch et al., 2016). Cronbach's alpha coefficient was 0.93, and Spearman-Brown coefficient is 0.82, which confirms the reliability of the research tool and the stability of the studied features. The correlation between the items of the questionnaire was evaluated in separate areas of the studied features using the non-parametric coefficient of Spearman's rank correla-

tion. The results showed a high degree of correlation (at the level of 0.7–0.8), which indicates a high degree of the construct validity of the questionnaire.

To survey a sample of Ph.D. students, a Google form was developed in three languages: Ukrainian, Polish and English (https://docs.google.com/forms/d/e/1FAIpQLSeVTEoPyK4KmpgacLF59GIqOOiTIbGA08Ypenx3u4tP9XPyBg/viewform). It is based on the Likert scale (On a scale of 1 to 5. rate the level of satisfaction (1 means complete dissatisfaction and 5 means the maximum level of satisfaction) and consists of 3 main sections:

- the first section covers the questions to fill in with the personal profile of the respondent (considering the country of affiliation, year of postgraduate study, the field of research; access level of IT and scientometric databases; self-assessment of the level of digital competences of citizens (Carretero Gomez et al., 2017) and researchers (Jisc, 2017b), motivation to develop their digital capabilities); based on the results of the answers to these questions, homogeneous expert groups were formed (the 1st task of the research);
- the second section consists of questions for self-assessment of the level of researchers' digital capabilities according to the Jisc Researcher profile (Jisc, 2017b); the received answers serve as the basis for an additional comparison of the digital capabilities of researchers across countries (I research task);
- the last section includes groups of questions (27 items) related to the main purpose of the research: assessing the importance of the main factors that influence the development of Ph.D. students' researcher's digital capabilities, in particular organisational digital capability (Jisc, 2017c) of universities where graduate students are trained (II objectives of the study).

Postgraduate students from three universities participated in the survey, where it was possible to organise the survey by considering the respondents' trust and their level of qualification: Borys Grinchenko Kyiv University (Ukraine), University of Silesia (Poland), and Extremadura University (Spain). These universities geographically represent Eastern, Central, and Western Europe; two of them are situated in the EU countries, and the third one is located outside with the perspective of joining the EU. All three universities participated in the European project entitled IRNet (www.irnet.us.edu.pl) in 2014–2017. The selected universities have developed scientific, methodological, and technological support sufficiently, the level of digitalisation of the educational process, and also the conditions for the training of graduate students – infrastructure, the competence of teachers, opportunities for academic mobility, etc.

In the course of data analysis, a set of methods and models was used, allowing to calculate all descriptive statistics and reveal the influence of individual studied characteristics on other characteristics. The choice of certain indicators was determined by the type of data, the rating scale, and the limitations of the methods. SPSS statistical data processing software (Levesque, 2005) was used for calculations.

To assess the degree of influence and importance of various factors on the young scientists' development of digital capabilities (postgraduate students) including the organisational digital capabilities of their educational institutions, we chose a 5-point Likert scale (Rate on a 5-point scale: 1-no effect, 5-defining effect). Since the sample consisted of only 50 respondents, it allowed us to choose non-parametric methods of

data analysis without taking into account the requirements for the normal distribution of characteristics and the size of the sample, as it is the case when using parametric methods of analysis. Thus, median scores and criteria based on the assessment of rank features were used to assess the homogeneity of responses for different groups of respondents. Independent-Samples Mann-Whitney U Test (Mann & Whitney, 1947; Neuhäuser, 2011) was used to compare survey results of two groups, and in the case of three or more groups – the Independent-Samples Kruskal-Wallis Test (Kruskal, 1952; Richardson, 2018). Further conclusions were made by respondents based on the analysis of survey results using graphic data visualization methods.

When testing statistical hypotheses at all stages of the analysis, the decision was based on the p-value, which reflects the probability of an error when rejecting the null hypothesis (errors of the first kind). The p-value for rejecting the null hypothesis was taken as 0.05.

Young researchers' attitude to organisational digital capability was a factor in the development of their digital capabilities in a comparison with others (the second research task), as well as connections between groups of respondents, who differ in affiliation of the university, where graduate students are trained in EU countries (in this case, it is Poland and Spain) and third countries (Ukraine), the following hypotheses are formulated:

H1: According to the respondents, the development of individual digital capabilities of researchers is equally determined by the activity of the graduate student himself/herself; the activity of the scientific supervisor; the competence of the teachers who provide the training; the level of digitisation of the educational institution; modern educational programmes; availability of a system of assistance support, mobility programmes; cooperation with scientists and other graduate students; the possibility of disseminating research results (graduate students, regardless of the country and educational institution, equally determine the impact of the specified factors on the development of their digital capabilities).

H2: All components of the university's digital capabilities (ICT infrastructure, Content and information, Research and innovation, Communication, Learning, teaching and assessment, and Organizational digital culture) are equally important for the development of graduate students' digital competence (graduate students, regardless of country and educational institution, equally define the conditionality of the development of own digital capabilities by the specified factors).

FINDINGS

For the creation of expert groups (the first research task) based on the results of the answers to the first questionnaire group from 126 graduate students, respondents with a sufficient level of digital competence and digital capabilities of the researcher (Kuzminska et al., 2021), a high level of motivation for its development and individual opportunities for its acquisition were selected (Table 1). No significant difference was found between the distributions of respondents from different countries (the analysis was conducted using the Independent-Samples Mann-Whitney U Test at the p-value = 0.05 level). To ensure the homogeneity of the expert groups, post-graduate students

in the field of social sciences in the 2nd year of study were also selected. An additional analysis of the formation of individual elements of the digital capabilities of graduate students from different universities based on the results of the answers to the second group of questions of the questionnaire confirmed the homogeneity of the identified groups in terms of these characteristics as well.

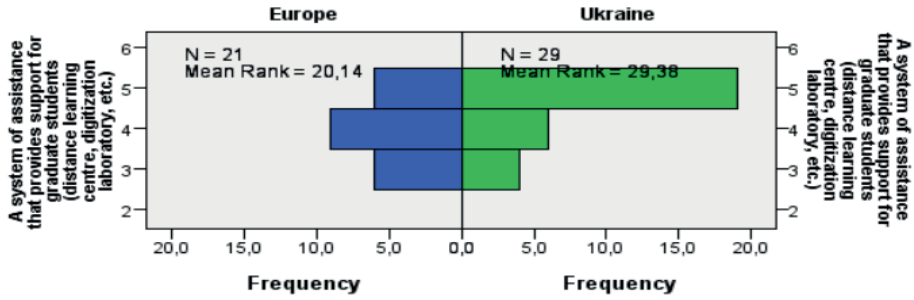
Table 1. The distribution of respondents' answers to the first group of questions, confirms the homogeneity of the studied groups

Where are you from?		Europe		Ukraine	
		Count	Column N %	Count	Column N %
Do you always have Internet access to computers and mobile devices when you need to find some information? *	Yes, I always have	18	85.70%	22	75.90%
	I have, but not always	3	14.30%	7	24.10%
	Access is very limited, I can rarely use digital devices	0	0.00%	0	0.00%
Do you have access to international databases of scientific journals and scientific publications? *	Yes, I always have	8	38.10%	8	27.60%
	I have, but not always	11	52.40%	16	55.20%
	Access is very limited, I can rarely use digital devices	2	9.50%	5	17.20%
Do you have your profile in science metric databases, such as Google Scholar, WOS, and Scopus?	Yes, and I have publications that are integrated into the relevant database	6	28.60%	12	41.40%
	Yes, I have, but I hardly use it	5	23.80%	6	20.70%
	No, I don't have one, but I plan to create one	10	47.60%	11	37.90%
Do you have your profile on the ResearchGate social network? *	Yes, I have, I am an active participant	6	28.60%	6	20.70%
	Yes, I have, but I hardly use it	9	42.90%	9	31.00%
	No, I don't have one, but I plan to create one	6	28.60%	14	48.30%
Do you think it is necessary to develop the researcher's digital competence in the process of Ph.D. study *	Yes	21	100.00%	29	100.00%
	No	0	0.00%	0	0.00%

Source: Own work.

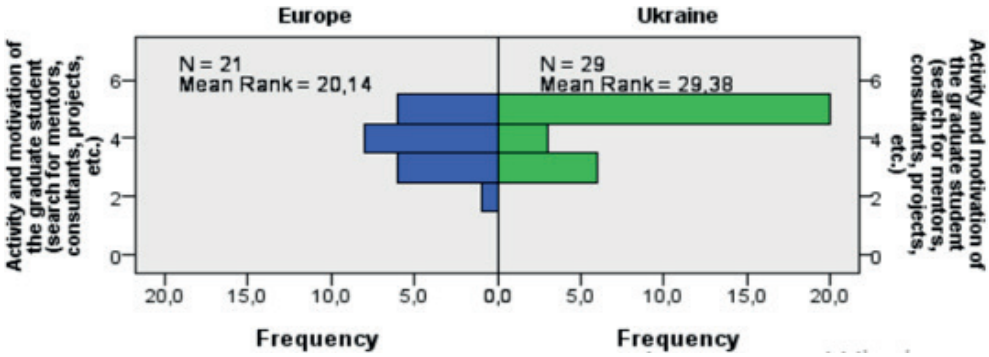
As a result, two groups of experts have formed: 29 postgraduate students from Ukrainian universities and 21 from European universities (7 from Spanish, 14 from Polish). Since the sample is small, non-parametric data analysis methods were used to assess and compare the main characteristics of the distributions. It should be noted that the small number of participants in each group in a certain way limits the audience of respondents, but still allows us to draw certain conclusions about existing trends and patterns and can be scaled, both at the level of the methodology of conducting and expanding the pedagogical experiment.

As a result of the analysis of the frequency distributions of the respondents' scores for each question of the third questionnaire group, which identified the factors with the highest level of determinants of the development of the graduate student's digital competence in the educational process at the university (the difference between the distributions was estimated using Kruskal-Wallis Independent-Samples Test) it was found that graduates, regardless of the university (country) where they study, among the factors with the greatest influence on the development of researcher's digital capabilities (the second research task) are: the digital environment of the educational institution where the graduate student studies; competent teachers who have a high level of digital competence and successfully use it in teaching classes; collaboration with fellow graduate students or other researchers (median = 5). However, a significant difference was found in the attitude of graduate students from European and Ukrainian universities regarding the influence of a system of assistance that provides support for graduate students (Figure 2) and Activity and motivation of the graduate student (Figure 3). The level of satisfaction is estimated on a scale of 1 to 5 (1 means complete dissatisfaction and 5 means the maximum level of satisfaction). The difference is significant at the p-value = 0.05. Hypothesis H1 can be considered partially confirmed. Moreover, it should be noted that postgraduate students of Ukrainian universities consider these factors to be the most influential (median = 5). The determined difference may indicate that Ukrainian graduate students take more responsibility for their development as scientists. Another reason may be some isolation of Ukrainian science from a single scientific space, therefore, more perseverance and initiative are needed for successful integration.



F i g u r e 2. Distribution of answers to the question "A system of assistance that provides support for graduate students (distance learning centre, digitisation laboratory, etc.)" by country

S o u r c e: Own work.

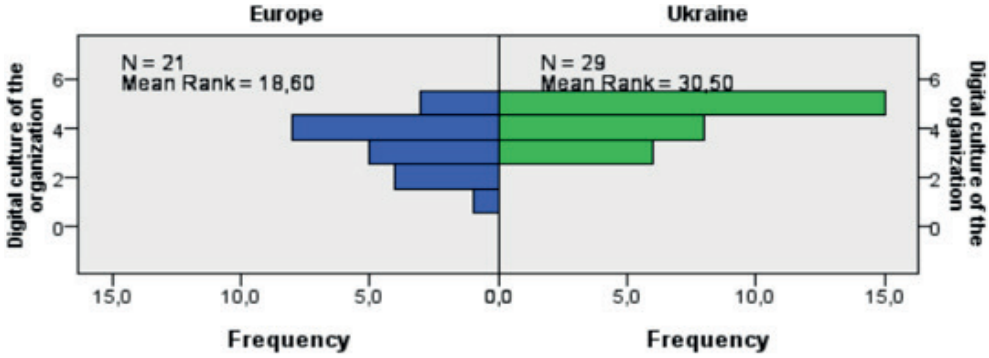


F i g u r e 3. Distribution of answers to the question "The distribution of Activity and motivation of the graduate student (search for mentors, consultants, projects, etc.)" by country

S o u r c e: Own work.

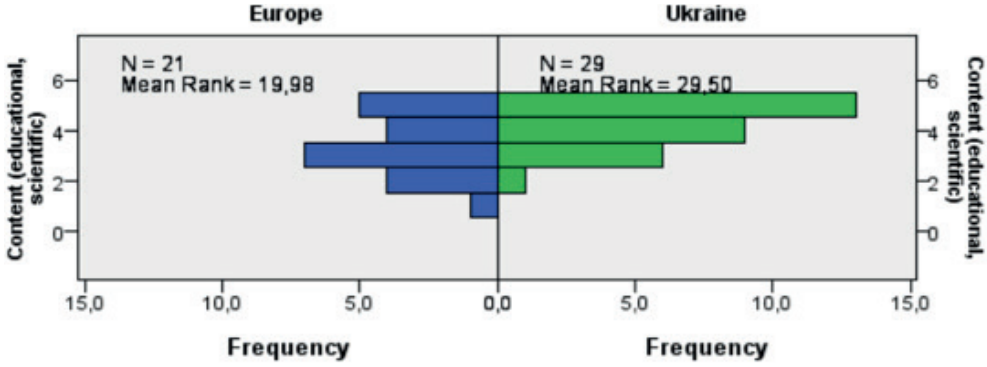
The analysis of the expert evaluation of organisational digital capability is the basis for rejecting hypothesis H2. In spite of the determination of the importance in all components of organisational digital capability for the development of the researcher's digital capabilities in both groups, a significant difference in the evaluation of 4 out of 6 components of the existing organisational digital capability in Ukrainian and European universities was determined. Thus, all respondents rated 5 out of 6 components of the existing organisational digital capability below the need; only Training, learning, and assessment meet their expectations. The biggest discrepancy was found in the attitude of European graduate students toward Communications and Digital infrastructure (in each case, the medians of expectations and realities are equal to 5 and 3, respectively). As for the analysis of responses by country, the representatives, regardless of the country, equally evaluated the distribution of Research and Innovation and Training, learning, and assessment as components of organizational digital capability. At the same time, Ukrainian graduate students generally rated the organizational digital capability of their university higher (Figure 4a–4d). The level of satisfaction is estimated on a scale of 1 to 5 (1 means complete dissatisfaction and 5 means the maximum level of satisfaction). The difference is significant at the p-value = 0.05. The latter can testify both to the sufficient level of digital capabilities of the university, and to the need for additional research related to the analysis of compliance with the requirements of Ukrainian graduate students to organisational digital capability to ensure the development of their digital capabilities.

As for the dissatisfaction with the development of the institutional Communications and Digital infrastructure, which, as a result of testing hypothesis H1, turned out to be important for the development of the researcher's digital capabilities in both groups, administrators of higher education institutions should take into account the need of graduate students to modernise the institutional IT infrastructure, in particular, to support open science and scientific communication.



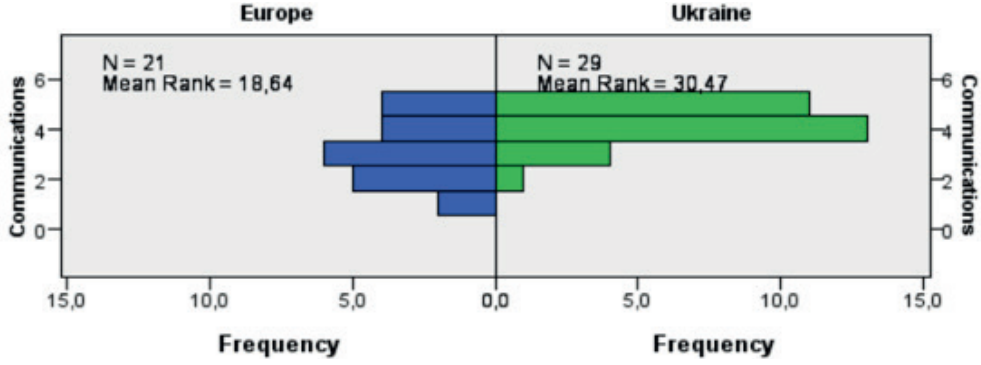
F i g u r e 4a. The answers to the question "Digital culture of the organisation" are distributed by country

S o u r c e: Own work.



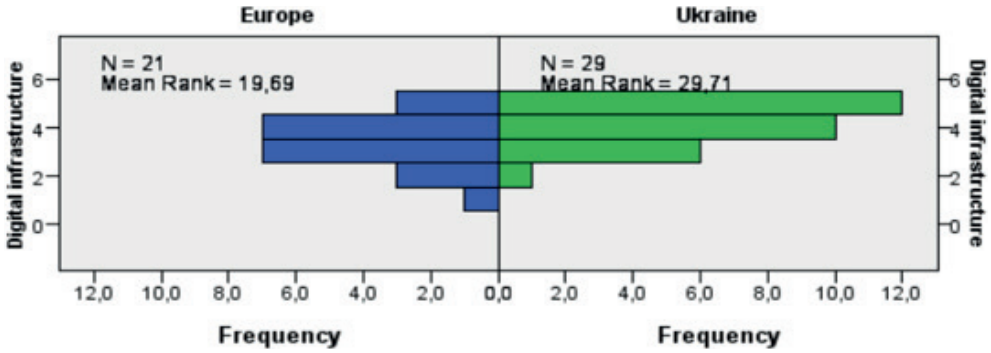
F i g u r e 4b. Distribution of answers to the question "The distribution of Content (educational, scientific)" by country

S o u r c e: Own work.



F i g u r e 4c. Distribution of answers to the "Communications" question by country

S o u r c e: Own work.



F i g u r e 4d. Distribution of answers to the question "Digital infrastructure" by country

S o u r c e: Own work.

Establishing effective communication at both vertical and horizontal levels, in particular, specialized training of research and teaching staff (Morze et al., 2017), who provide training for graduate students, will help.

CONCLUSION

The development of modern digital technologies and knowledge-intensive industries actualizes the need to train specialists with advanced digital capabilities.

The experience of the Jisc organisation, which provides digital solutions for education and research in Great Britain, is the basis for conducting additional studies related to the scaling of individual digital capabilities models, in particular, the researcher's digital capabilities, and organisational digital capability in the context of digital transformation of universities in different countries.

Based on the results of an empirical study conducted to determine the attitude of Ph.D. students of Borys Grinchenko Kyiv University (Ukraine), University of Silesia (Poland), and Extremadura University (Spain) to digital opportunities at the individual level and the level of educational organisations:

1. It was confirmed (according to the results of an online survey of selected homogeneous experimental groups of postgraduate students of Ukrainian universities – 1 group, and universities of EU countries – 2 groups) that they show a high level of readiness to develop the researcher's digital capabilities;
2. The factors that have the greatest influence on the development of the researcher's digital capabilities include the following: the digital environment of the educational institution where graduate students study; competent teachers who have a high level of digital competence and successfully use it in conducting classes; collaboration with fellow graduate students or other scientists;
3. A sufficient level of the existing distribution of Research and Innovation and Training, learning, and assessment as components of the organisational digital capability of universities, where graduate students are trained, and the need to

improve institutional Digital infrastructure and Communications have been identified.

4. Although, in general, no significant difference was found in the attitude towards the development of digital capabilities of graduate students from different countries, graduate students from Ukraine rated the organisational digital capability of their university higher, while graduate students from EU countries need more powerful Digital infrastructure and Communications (in each in this case, the medians of expectations and realities are equal to 5 and 3, respectively).

Taking into account the small number of participants in each group (related to the limitations of this study), we consider the obtained results as a basis for expanding the pedagogical experiment both by expanding the audience of respondents (both quantitatively and qualitatively, for example, involving representatives of various categories of educators as experts), and higher education institutions from different countries. We attribute the latter to the prospects of further research.

At the same time, since the available results reflect certain trends, they can already be useful to representatives of higher education institutions for monitoring and developing (if necessary) existing organisational digital capabilities for improving individual digital capabilities of subjects of the educational process and digitalisation of education.

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