EMPLOYEE TRAINING TO INCREASE DIGITAL LITERACY

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The paper is an output of the project VEGA No. 1/0188/24 Hybrid work regimes as a result of companies learning from the crisis and the implications of their implementation for the people management.

Abstract: The intention of our research was to examine the content and scope of education (stated in hours) to enhance digital literacy required for the profession, where we examined selected forms of education. The research was conducted by questionnaire survey. The aim of the paper was to highlight the importance of different areas of education in the development of digital knowledge and skills and to recommend preferred forms of education in each area of digital literacy. The results of the research show that employees in our research sample used self-education the most, followed by peer-to-peer education. Organized learning was used only minimally. Statistical significance was demonstrated in the case of self-education in different content areas of digital literacy. Statistical significance was not demonstrated for the difference in the forms of education from the original education or from the current job position.

Keywords: digital literacy, digital skills, self-education, peer to peer education, organized learning, Education 4.0, Education 5.0, hybrid work regimes.

1 Introduction

Digital literacy is now a frequently discussed issue in the context of the preparation and implementation of education, both nationally and internationally. Already a few years ago, the concept of a new industrial revolution, referred to as Industry 5.0 (European Commission, 2021) and Society 5.0 (Deguchi et al., 2020), was presented, associated with new technologies, innovations and the extension to virtual environments (Green, 2012). Turbulent changes in the business environment have also been caused by the Covid-19 pandemic, which has forced businesses to move some of their activities to virtual environments (Meinck et al., 2022). The fact is that in many organizations the pandemic brought about an increase in digitalization, which was implemented very quickly, while Covid-19 was considered not only a crisis but also a disaster (Šrobárová & Bursová, 2021). Many experts and specialists who work on digitalization in specific organizations claim that their organizations, instead of many years of digital transformation, implemented it in a matter of months, which was triggered by the Covid pandemic (Lambert, 2020).

During the pandemic, employees were much more willing to try ICT at work and for learning without necessarily being sure of the results. During rapid change, it is high adaptability that is an indicator of the health of an organization that supports and enhances a successful work environment (Kane et al., 2020).

According to UNESCO (Meinck et al., 2020), the main consequence of the Covid 19 crisis was the closure of schools and universities, almost overnight. In educational institutions, there was a transition from physical education at the time to an emergency solution in the form of distance learning (Garcia et al., 2021). Distance education, which until this time had taken a completely different form, was introduced immediately as a necessary measure against the spread of the Covid 19 pandemic. For lecturers and teachers, this meant a new form of teaching but also self-efficacy in pre-service teacher training (Duda et al., 2022). Many organizations that have discontinued physical working regimes have embraced the technologies available for online work activities and also for staff development training. This implemented change in education maintains its position to be able to implement hybrid work modes and to implement various blended learning modalities in a combination of physical and online learning, continuous education of employees in digital skills is essential.

The aim of the paper was to highlight the importance of different areas of education in the development of digital knowledge and skills and to recommend preferred forms of education in each area of digital literacy. The aim of the paper corresponds to the requirements for a fundamental transformation of Industry 5.0 (Maddikunta et al., 2022; Schröder et al., 2024) and also Society 5.0 (Dautaj & Rossi, 2021; Matsuda et al., 2019). The fifth industrial revolution is driven by digital technologies such as artificial intelligence, the Internet of Things, robotics or big data. Industry 5.0 is a broad concept whose relevance evolves as technologies advance, and no one knows exactly what final form it will take, which makes great demands on the preparation of education that should precede the processes of practical implementation (Richnák & Sármány, 2019). Industry 5.0 is changing traditional production processes and the way entire industries operate, while also significantly affecting the labor market and social structures. With increasing automation and digitalization, not only the needs of employers are changing, but also the knowledge and skill requirements of workers (Amjad et al., 2024; Mulongo, 2024; Amirkhizi et al., 2024).

2 Education for increased digital literacy – theoretical background

Nowadays, the digitalization and intelligence of the production process is an inevitable attribute in all sectors of the national economy. Businesses are facing rapid advances and are able to increase productivity and save costs thanks to real-time data and business connectivity.

The content of employee education is adapting to the requirements of Industry 5.0 and the functioning of businesses in a globalized environment. Knowledge of technology, working with data, artificial intelligence and overall orientation in the 5.0 world are becoming essential. Responding flexibly to today's conveniences gives businesses a competitive advantage and provides opportunities even for small organizations that can leverage appropriate technologies. Industry 5.0 itself is based on the integration of modern technologies and the digitalization of many production processes. Employee education needs to be adapted to this wave of development, which is the subject of our next investigation.

2.1 Literature review

Education in different stages of technological development is referred to in the literature as Education 1.0, 2.0, 3.0, 4.0 and 5.0. currently we find it as Education 4.0 stage (Mukul & Büyüközkan, 2023), which is gradually transforming into Education 5.0 (Ahmad et al., 2023).

The implemented education must capture areas that provide a new level of organization and control of the entire value chain of the life cycle of products and services provided. Customer requirements cannot be eliminated in these processes, where smart and open platforms and networked information applications are used. The use of applications is for real-time data monitoring, focuses on instructions to control the production processes and also to monitor the status of products (Vaidya et al., 2018).

Education must be in line with the requirements that are the basic characteristics for the use of new technologies, especially the Internet of Things (IoT), big data, various forms of cloud computing, additive manufacturing (3D printing), automation and robotization and other technologies. which are gradually being implemented in all work activities (Jadeja &Modi, 2012; Maddikunta et al., 2022, Chakraborty et al., 2023).

2.2 Theoretical background of the research

The facts presented in subsection 2.1 place demands on staff education. The education system should therefore not only develop technical skills, but also promote the so-called core competences. We have drawn on the key competences for lifelong learning, which have been outlined in a document by the European Commission and the European Parliament (European Commission, 2019).

In preparing this paper, we have looked at one of the important key competences, which has been characterized as digital competences. In order to carry out empirical research, we have developed groups of these digital competences, which we analyze in terms of the scope of teaching and the forms of learning applied. Industry 5.0 requires changes in the labor market and urgently needs skilled professionals who have the necessary competencies and skills to thrive in this new environment (Hernandez-de-Menendez et al., 2020; Chen et al., 2022).

Digitalization is fundamentally transforming traditional educational processes, opening up new opportunities and challenges. With the advent of technologies such as e-learning platforms, the way we learn is changing dramatically. Digitalization enables access to a wide range of resources and information, promotes flexibility in learning and enhances the personalization of learning according to the individual needs of learners. It also places emphasis on autonomy and responsibility. The development of digital and online learning opportunities, which are integrated not only into formal education but also into further education, places and creates changed demands on learning management. It is imperative that the strategies and teaching forms of educational institutions adapt to new trends closely related to technology and digitalization (Digital Coalition, 2024; Takáčová, 2024). The key demands of globalization and Industry 5.0 require fundamental changes in education, which include:

- self-education and taking advantage of all available learning opportunities,
- learning within work teams, peer-to-peer
- organized learning that is didactically and methodologically sound and is carried out individually, in groups or collectively,
- individualized learning, which focuses more on the specific needs of the trainees,
- further education for andrologists oriented towards the preparation and development of skills in the field of modern technologies. Personality as a factor in the learning and teaching process also plays an important role in education (Czarkowski et al., 2023).

In particular, the development and promotion of a culture of digital learning and increased flexibility in the teaching and learning process are key factors for sustainability (Luna et al., 2024).

Digital transformation can be seen as a more complex concept that encompasses not only the process of digitalization but also the organizational changes that go with it. These changes fundamentally affect the ways in which an institution delivers educational services and responds to the needs of its learners, staff and partners.

For the forms of learning, we have drawn on only some of the forms of learning as outlined in the key requirements for globalization and Industry 5.0. Since we have worked with them in our empirical research, we give a brief description of them. Among the forms of education studied, on the basis of the above-mentioned literature sources, we have included:

- The process of self-education takes place without direct interaction with a lecturer, instructor, consultant.
- The controlling (riadiaci/managing) subject is the learning subject (adult individual).
- Self-study is a complex educational process, the effectiveness of which is conditioned by,
  - that the learner has clearly clarified goals,
  - has the capacity for self-assessment,
  - has the ability and opportunity to compare his/her learning outcomes with the learning objectives,
  - has the capacity for self-motivation.
- For self-study, it is necessary to provide the learner with appropriate study aids and also the possibility of consultation and guidance in learning. Consultations are mostly carried out individually, but can also be carried out in groups (especially in corporate education), either face-to-face or at a distance (including correspondence counselling). It may be appropriate to provide a degree of guided self-study to assist the trainee. It is oriented towards explanations, advice, recommendations, guidance on the usually more difficult parts of the education content.
- Distance learning in the form of off-line e-learning is also appropriate for further education and independent study (self-study). Off-line e-learning allows self-study support in the form of prepared educational documents.

Peer to peer learning in the sense of employee to employee i.e., one to one learning (Pizzul et al., 2024; Zhao et al., 2021):
Participants in this form of education can also be grouped together and prepared for what they will be educated in. By forming such smaller groups, space is created for trainees to demonstrate their knowledge, skills, and abilities, and also to demonstrate how they can respond promptly to ideas that arise and develop them creatively. The individual or group will be given an assigned topic to develop and prepare and then implement the learning.

Organized learning, where we focused on the breakdown of forms of education according to the number of learners. In continuing professional education, it is necessary to work with individual, group and mass education.

According to the way of organization of the activity of the educator and the participants of education, we dealt with individualized education. Individualized education presupposes the introduction of a system of diagnostics and spatial and temporal individualization of the educational program. Mostly, a modular system is used in individualized education, where participants are classified according to their abilities (Ahmad et al., 2023). Individualized learning requires the use of other forms of guided learning where physical learning, distance learning as a multimedia form of learning can be mentioned. In distance learning, it is appropriate to apply e-learning whether offline or online. Online education is nowadays implemented in asynchronous and synchronous versions.

In addition to one form of education and the other, a combination of these forms of education can also be used, which can be characterized as blended learning. Hybrid learning is a specific form of learning where learning takes place both physically and online at the same time. This form of learning requires its own further exploration. It needs to be distinguished from Blended learning, which is used in a type of learning where face-to-face learning is combined or blended with e-learning. E-learning is usually just a complement to physical/face-to-face learning.

It is important for educational institutions to integrate digital technologies into teaching and create an environment that supports lifelong learning and the development of the necessary digital skills for the work environment. Innovative approaches such as project-based learning and online learning are essential to ensure the relevance of educational content in today's rapidly changing world.

In our empirical research, we look at digital knowledge and skills education as one of the components of employees' core competencies. The intention of our research was to examine not only the content of training in this area, but also the appropriate forms of education that employees find effective in the context

of lifelong learning in the field of IT. This research is in line with the objectives of the VEGA project No. 1/0188/24 Hybrid work regimes as a result of companies learning from the crisis and the implications of their implementation for the people management. On the basis of the conducted research, we identify the training needs of employees and recommend appropriate forms of training.

3 Research methodology

In terms of our research design, we sought to find out

- which form of education is preferred by respondents with a higher level of initial education,
- which form of education is preferred by line managers and which by employees – specialists,
- the content area of digital literacy to which respondents devote most of their time.

The research was conducted based on five sets of hypotheses, which were formulated as null and alternative as follows:

1H0: the number of hours of self-education of employees in the field of improving digital literacy does not depend on their education.
1H1: self-education in digital literacy is preferred by employees with a higher level of education.

2H0: the number of hours of peer-to-peer education of employees in digital literacy is independent of their educational background.
2H1: peer-to-peer training in digital literacy is preferred for employees with higher levels of education.

3H0: the number of hours of self-directed digital literacy education for employees is independent of their job title.
3H1: Employees who are specialists in their field spend more time on self-education than other employees.

4H0: the number of hours of peer-to-peer training of employees in digital literacy does not depend on their job position.
4H1: Specialist – technologists in the field spend more time on self-education than other employees.

5H0: the number of hours of employee self-education does not vary by content area of digital literacy.
5H1: the number of staff self- education hours varies according to the content area of digital literacy.

In order to verify the research hypotheses, a research model was created (Table 2. .. Table 6) and then a questionnaire survey was conducted among line managers and employees – specialists in food production from Slovakia, the Czech Republic and Spain. According to the occupational classification (SK ISCO-08, 2020): these are line managers (No. 3122001 Foreman/supervisor in food production) and employees (No. 2141002 Specialists – technologists in food production and No. 3142006 Technologist in food production).

The questionnaire survey was conducted in January-February 2024. Respondents assessed the use of three forms of educations in five areas of digital literacy, namely self-learning, peer-to-peer education and organized education. They reported the number of hours they had spent on each form of learning over a 6-month period and, on a 7-point Likert scale ranging from 0 to 6 (according to Bloom's taxonomy), the level by which their knowledge of the subject had improved, based on their own judgement.

Note: the meaning of Bloom's taxonomy is 0 – not required, 1 – remember level, 2 – understand level, 3 – apply level, 4 – analyze level, 5 – evaluate level, 6 – create level (DigComp, 2024).

In addition to the standard methods of scientific work (analysis, synthesis, comparison), methods of evaluation of research variables in Excel and statistical verification of hypotheses in Jamovi were used in the paper. We used the following statistical tests, tools and coefficients: descriptive statistics, Cronbach's α and McDonald's ω, Shapiro-Wilk test of normality, Levene's test, non-parametric alternative of Independent Samples T-Test (Mann Whitney test), non-parametric alternative of ANOVA test (Kruskal-Wallis test).

4 Results and Discussion

We present the results of our investigation in the following structure: research sample, model of research variables, reliability of the research instrument, descriptive statistics and outliers of the results, testing the statistical significance of the research hypotheses, and drawing conclusions.

4.1 Research sample

The research sample consisted of 186 respondents from industry C – Manufacturing, division 10 – Food manufacturing, 11 – Beverage manufacturing (according to SK NACE). The detailed specification of the research sample is presented in Table 1.

Table 1 Research sample

Parameters		No.	% share
P1 – country	Slovak Republic	61	32.81
	Czech Republic	68	36.56
	Spain	57	30.65
P2 – education	Secondary education	51	27.42
	Higher education	135	72.58
P3 – function in the company*	Line manager	106	56.99
	Employee – Specialist	80	43.01

* Note: in terms of the Statistical Classification of Occupations line manager represents No. 3122001 Foreman/supervisor in food production and Employee No. 2141002 Specialists – technologists in food production and No. 3142006 Technologist in food production.
Source: own processing

4.2 Model of research variables

The model of research variables consisted of five groups of variables characterizing the 5 research areas in which respondents assessed the form of education implemented (Table 2...Table 6).

Table 2 Information and data literacy research variables

I.	**INFORMATION AND DATA LITERACY (working with the Internet)**
DL1.1	Getting up-to-date information for work (exchange rate tickets, tax returns, weather information, pollen situation,...)
DL1.2	Using information from published price lists for goods and services
DL1.3	Filling in and sending online forms to state and public institutions (health insurance, social security,...)
DL1.4	Using information from maps and navigation
DL1.5	Use of information published by public authorities and institutions (government, ministries, statistical office, tax office, social security, health insurance,...)
DL1.6	Use of data from publicly available portals (cadastral portal, trade register, commercial register, FINSTAT...)
DL1.7	Use of published publicly available data from the Internet (Open data)
DL1.8	Use of data from commercial databases (Albertina, Datamax, European databank, Kompass, Zlaté stránky,...)
DL1.9	Implementation of online marketing

Source: own processing

Table 3 Research variables of the Communication and cooperation area

II.	COMMUNICATION AND COLLABORATION AREA (collaboration tools and social networks)
CC2.1	Use of MS Outlook
CC2.2	Use of Google Calendar
CC2.3	Using MS Exchange
CC2.4	Using Google Drive file sharing
CC2.5	Use of social networks (Facebook)

Source: own processing

Table 4 Research variables of the Digital Content Creation area

III.	DIGITAL CONTENT CREATION AREA (office tools and enterprise IS)
DC3.1	Use of MS Office and all its applications
DC3.2	Use of MS Excel to create calculations and graphs
DC3.3	Use of MS Word for administration
DC3.4	Use of MS PowerPoint for presenting
DC3.5	Use of other office software
DC3.6	Use of all enterprise IS modules
DC3.7	Use of selected IS modules according to job role
DC3.8	Use of the employee portal (data related only to a specific employee – absence records, leave,...)

Source: own processing

Table 5 Research variables of the Security area

IV.	SECURITY AREA
CS4.1	Use of an appropriate and up-to-date internet browser, e.g. Microsoft Edge, Google Chrome, Mozilla Firefox, Opera
CS4.2	Use of effective anti-virus protection
CS4.3	Regular backup of important data
CS4.4	Knowing the meaning of http cookies
CS4.5	Verify the security of connections to websites where an employee enters sensitive information to prevent leakage of sensitive information (phishing)
CS4.6	For any email message that requests a password check or other sensitive data, checking to ensure that it is not a fake sender

Source: own processing

Table 6 Research variables of the problem solving area

V.	PROBLEM SOLVING AREA
PS5.1	Technical problem solving
PS5.2	Identification of needs and technological solutions
PS5.3	Creative use of digital technologies
PS5.4	Identifying gaps in digital competence

Source: own processing

4.3 Reliability of the research instrument

The research instrument (questionnaire) contained five groups of variables listed in the research model. The individual variables were assessed both absolutely (number of hours) and using a scale from 0 to 6 (improvement by a level), so we only report the reliability of the respective scale. Reliability was tested using Cronbach's α and McDonald's ω.

The scale reliability of the group of variables assessing self-education reached α=0.808, ω=0.875 (overall). Reliability of individual variables reached α values from 0.787 to 0.828, ω from 0.856 to 0.881.

The scale reliability of the group of variables assessing peer to peer education reached α=0.794, ω=0.872 (overall). Reliability of individual variables reached α values from 0.771 to 0.814, ω from 0.852 to 0.878.

In the case of organized education, we do not report the reliability due to the low number of responses, so we did not include this part in the statistical treatment.

The reported reliability values of our research instrument meet the required values of Cronbach's a>0.7 (Hanák, 2016); Kolarčík, 2013; Marko, 2016). The calculation was supplemented with the McDonald's ω coefficient, whose values confirm sufficient internal consistency of the questionnaire used in the survey (Imdad, 2018; Marko, 2016).

4.4 Descriptive statistics and description of outliers

Table 7 Evaluation of information and data literacy education

	Self-education (hrs)	Self-education (level improvement)	Peer to peer education (hrs)	Peer to peer training (level improvement)	Organized learning (hrs)	Organized learning (level improvement)
DL1.1	11.55	1.65	2.99	1.65	0	0
DL1.2	4.06	1.36	2.57	1.36	0	0
DL1.3	19.11	3.60	5.69	3.6	0	0
DL1.4	5.23	2.88	0.82	2.88	0	0
DL1.5	14.95	5.09	0	0	0	0
DL1.6	3.89	3.83	3.89	3.83	0	0
DL1.7	2.34	4.53	2.3	4.53	0	0
DL1.8	1.91	3.34	1.34	3.34	0	0
DL1.9	1.37	2.04	5.77	2.04	34.89	3.49
Average	**7.16**		**2.82**		**3.88**	

Source: own processing

Table 7 shows that respondents spent an average of 7.16 hours on self-education in Information and Data Literacy in the last six months. They were above average in the variable DL1.1 – *Getting up-to-date information for work (course tickets, tax return, weather information, pollen situation,...)*, with 11.55 hours, DL1.3 – *Filling in and sending online forms to state and public institutions (health insurance, social insurance,...)*, 19.11 hrs. and DL1.5 – *Using information published by state bodies and institutions (government, ministries, statistical office, tax office, social insurance, health insurance,...)*, 14.95 hrs. In this variable they also declare the greatest improvement in their knowledge, up to 5 levels. Another interesting improvement of up to 4.53 points occurred in the variable DL1.7 – *Use of published publicly available data from the Internet (Open data).* It is also worth mentioning the declared improvement in variable DL1.6 – *Use of data from publicly available portals (cadastral portal, trade register, commercial register, FINSTAT...), by* 3.83 points.

Respondents spent on average only 2.82 hours per half year on peer-to-peer training, most of them in the variables DL1.9 – *Implementation of online marketing*, DL1.3 – *Filling in and sending online forms to state and public institutions (health insurance, social insurance,...)* and DL1.6 – *Using data from publicly available portals (cadastral portal, trade register, business register, FINSTAT,...)*. In the variable DL1.5 – *Use of information published by state authorities and institutions (government, ministries, statistical office, tax office, social insurance office, health insurance office,...)*, this form was not used at all. The highest improvement is reported in variable DL1.7 (similar to self-education).

Organized learning was only used by respondents in the case of variable DL1.9 – *Implementation of online marketing*, where they improved by 3.9 points in this form.

Table 8 Evaluation of the Communication and Cooperation learning area

II.	Self-education (hrs)	Self-education (level improvement)	Peer to peer education (hrs)	Peer to peer training (level improvement)	Organized learning (hrs)	Organized learning (level improvement)
CC2.1	81.97	3.62	6.26	3.62	0	0
CC2.2	5.47	5.48	2.38	5.48	0	0
CC2.3	1.08	0.06	1.31	0.38	0	0
CC2.4	0.18	5.49	1.6	5.49	0	0
CC2.5	3.56	5.8	4.89	5.8	0	0
	18.45		3.29		0	

Source: own processing

In the area of Communication and Collaboration, respondents spent the most time on learning in variable CC2.1 – *Use of MS Outlook*, where they improved by 3.62 points. However, they report the highest improvement in the variables they spent less time studying, namely CC2.5 – *Use of social networking sites*

(Facebook), CC2.4 – *Use of file sharing through Google Drive*, and CC2.2 – *Use of Google Calendar*.

Peer to peer education also received the most improvement in variable CC2.1 and also in variable CC2.5. Similarly, the greatest improvements were in the variables consistent with self-education, namely CC2.5, CC2.4, and CC2.2.

Organized learning was not used at all by respondents in this area.

Table 9 Evaluation of Digital content creation education area

III.	Self-education (hrs)	Self-education (level improvement)	Peer to peer education (hrs)	Peer to peer training (level improvement)	Organized learning (hrs)	Organized learning (level improvement)
DC3.1	134.85	5.35	34.25	5.35	0	0
DC3.2	225.46	4.41	51.17	4.41	60.62	3.02
DC3.3	121.3	5.72	5.77	5.72	0	0
DC3.4	14.27	6.00	3.48	6.00	0	0
DC3.5	0	0	0	0	0	0
DC3.6	4.11	5.32	3.03	5.32	0	0
DC3.7	6.17	5.28	6.35	5.28	0	0
DC3.8	7.46	5.7	3.6	5.7	0	0
	64.20		13.46		7.58	

Source: own processing

Respondents spent the most time on Digital content creation education (average 64.20 hours) and the longest time on variables DC3.2 – *Using MS Excel to create calculations and graphs*, DC3.1 – *Using MS Office and all its applications* and DC3.3 – *Using MS Word for administration.* However, they also report a large improvement for other variables in this area (Table 4), with the highest value for DC3.4 – *Use of MS Power point for presenting*. The exception is variable DC3.5 – *Use of other office software, which* was not studied at all. Higher values in this area were also observed in the case of peer-to-peer learning, which, with lower values, reflect the values achieved by self-education. In variable DC3.2, respondents also declared organized learning, in which they achieved an improvement of 3.02 points.

Table 10 Evaluation of the Security education area

IV.	Self-education (hrs)	Self-education (level improvement)	Peer to peer education (hrs)	Peer to peer training (level improvement)	Organized learning (hrs)	Organized learning (level improvement)
CS4.1	16.00	4.36	2.03	4.36	0	0
CS4.2	16.28	6.00	5.64	6	0	0
CS4.3	3.70	6.00	3.27	6	0	0
CS4.4	2.63	1.36	12.91	0.78	0	0
CS4.5	2.74	1.36	2.74	1.36	0	0
CS4.6	0.97	5.81	2.85	5.81	0	0
	7.05		4.91		0.00	

Source: own processing

Of the staff self-education in the area of Security, we can highlight the time spent studying in variables CS4.1 – *Use of appropriate and up-to-date internet browser, e.g., Microsoft Edge, Google Chrome, Mozilla Firefox, Opera* and CS4.2 – *Use of effective anti-virus protection*, although the maximum improvement to a value of 6 is indicated in variables CS4.2 and CS4.3 – *Regular backup of important data*, although less time was spent on education in variable CS4.3.

The same values of improvement were declared by the respondents for the above-mentioned variables CS4.2 and CS4.3 for peer-to-peer education.

Organized education in the area of security was not implemented by the respondents at all.

Table 11 Evaluation of Problem-solving education

V.	Self-education (hrs)	Self-education (level improvement)	Peer to peer education (hrs)	Peer to peer training (level improvement)	Organized learning (hrs)	Organized learning (level improvement)
PS5.1	0.32	0.33	2.42	0.33	23.01	1.73
PS5.2	2.06	0.98	7.97	0.98	0	0
PS5.3	2.48	1.2	10.03	1.2	42.8	2.36
PS5.4	5.63	1.59	14.2	1.59	0	0
	2.62		8.66		16.45	

Source: own processing

The area of Problem Solving (in IT) differs from the other areas in that respondents spent the least amount of time on self-education, and improvement through self-education is also low. They took longer to learn through peer to peer, also with low improvement.

As with the only area studied, they spent the most time on organized learning, but only for the two variables PS5.1 – *Technical problem solving* and PS5.3 – Creative use of digital technologies, with an interesting improvement (of 2.36 points) was reported only for the PS5.3 variable.

The results presented in Tables 7 to 11 show that respondents from our research sample spent the most time on self-education, in four of the five areas studied, followed by peer-to-peer education. They made only minimal use of organized learning.

4.5 Testing the statistical significance of the hypotheses

Independent Samples T-Test, Mann Whitney U and ANOVA and Kruskal-Wallis were used to test the statistical significance of the stated hypotheses.

Testing the statistical significance of hypothesis 1

Hypothesis 1 concerned the amount of time respondents spent on self-education in each of the areas studied in relation to educational attainment. Only employees with secondary and tertiary education were represented in our research sample, therefore Independent Samples T-Test was used for testing. The assumptions of using an appropriate T-test coefficient were made by Shapiro Wilk test and Levene's test. Both tests resulted in a low p-value, which in the case of the Shapiro Wilk test means "a violation of the assumption of normality" and in the case of the Levene's test means "a violation of the assumption of equal of variances". Therefore, the non-parametric Mann Whitney U test was used for testing. The results and significant values of all tests are presented in Table 12. The interpretation of the testing of the number of hours of self-education is similar across all study areas based on the data in Tables 12, 13, 14 so as an example we present the interpretation of the sum of the number of hours of self-education for all study areas in the research model: Employees with a college degree (n = 135) did not spend more time (M=625, SD=131) on self-education than employees with a high school degree (n=51), (M=617, SD=145). The difference (8) is not statistically significant (U=352, p=0.391) with a trivial difference effect (Effect size=0.0026).

Table 12 Preconditions for the use of an appropriate test (1H)

	Normality Test Shapiro Wilk		Homogeneity Test Levene´s			
	W	p	F	df1	df2	p
DL	0.983	0.025	2.78	1	184	0.097
CC	0.919	<0.001	0.938	1	184	0.334
DC	0.935	<0.001	1.60	1	184	0.207
CS	0.977	0.004	2.72	1	184	0.101
PS	0.932	<0.001	2.8	1	184	0.151
Total	0.976	0.003	0.978	1	184	0.324

Source: own processing

Table 13 Descriptive statistics (1H)

	Descriptives					
	Group	N	M	MD	SD	SE
DL	Secondary	51	62.9	59.0	16.3	2.28
	Higher	135	65.0	65.0	14.1	1.22
CC	Secondary	51	88.6	82.0	54.3	7.60
	Higher	135	93.6	97.0	58.1	5.00
DC	Secondary	51	413	426	115	16.1
	Higher	135	414	439	122	10.5
CS	Secondary	51	42.5	42.0	5.42	0.759
	Higher	135	42.2	42.0	4.95	0.426
PS	Secondary	51	10.6	10.0	2.64	0.370
	Higher	135	10.5	10.0	2.30	0.198
Total	Secondary	51	617	656	145	20.3
	Higher	135	625	640	131	11.3

Source: own processing

Table 14 Mann Whitney U test results (1H)

	Mann Whitney U		
	Statistic	p	Effect size
DL	3173	0.205	0.078
CC	3276	0.306	0.049
DC	3359	0.400	0.024
CS	3331	0.635	0.033
PS	3282	0.691	0.047
Total	3352	0.391	0.026

Source: own processing

Since there was no statistically significant difference in the individual areas examined, we accept hypothesis 1H0 and reject hypothesis 1H1.

Testing the statistical significance of hypothesis 2

Similar to Hypothesis 1, Hypothesis 2 relates to the amount of time that respondents have spent on education to increase their digital literacy, but focuses on peer-to-peer education in relation to educational attainment. The validation procedure is the same, the results are presented in Tables 15, 16, 17.

We provide an interpretation of the sum of the number of hours of peer-to-peer education for all areas studied: employees with a college degree (n=135) did not devote more time (M=211, SD=27.0) to peer-to-peer education than employees with a high school degree (n=51), (M=216, SD=25.5). Difference (5) is not statistically significant (U=2956, p=0.931) with a trivial difference effect (Effect size=0.141).

Table 15 Preconditions for the use of an appropriate test (2H)

	Normality Test Shapiro Wilk		Homogeneity Test Levene´s			
	W	p	F	df1	df2	p
DL	0.989	0.179	0.172	1	184	0.679
CC	0.975	0.002	17.30	1	184	< 0.001
DC	0.934	<0.001	0.866	1	184	0.353
CS	0.979	0.007	1.740	1	184	0.188
PS	0.980	0.009	0.100	1	184	0.752
Total	0.939	<0.001	0.850	1	184	0.358

Source: own processing

Table 16 Descriptive statistics (2H)

	Descriptives					
	Group	N	M	MD	SD	SE
DL	Secondary	51	24.7	24.0	4.67	0.654
	Higher	135	24.3	24.0	4.66	0.401
CC	Secondary	51	16.9	17.0	3.03	0.425
	Higher	135	16.2	16.0	1.97	0.169
DC	Secondary	51	111	106	24.5	3.430
	Higher	135	106	101	26.1	2.250
CS	Secondary	51	29.3	29-0	2.40	0.336
	Higher	135	29.5	29.0	2.67	0.230
PS	Secondary	51	34.8	35.0	4.10	0.575
	Higher	135	34.6	34.0	3.56	0.306
Total	Secondary	51	216	211	25.5	3.570
	Higher	135	211	204	27.0	2.330

Source: own processing

Table 17 Mann Whitney U test results (2H)

	Mann Whitney U		
	Statistic	p	Effect size
DL	3292	0.678	0.044
CC	3092	0.861	0.102
DC	3039	0.891	0.117
CS	3331	0.366	0.032
PS	3296	0.674	0.043
Total	2956	0.931	0.141

Source: own processing

Again, we accept the null hypothesis 2H0 and reject the alternative hypothesis 2H1.

Testing the statistical significance of hypothesis 3

Hypothesis 3 concerned the amount of time respondents spent on self-education in each of the areas studied in relation to their job position. Again, the job position variable took only 2 values, namely line manager and employee-specialist, so again the Independent Samples T-Test was used. The results are presented in Tables 18, 19, 20. We interpret the overall result:

Line managers (n=106) did not devote more time (M=604, SD=14.2) to self-education than employee – specialists (n=80), (M=649, SD=12.1). Although statistically significant (U=3401, p=0.010), the difference (45) is trivial (Effect size=0.198).

Although the overall difference is statistically significant ($p<0.05$), this is not the case in all areas of digital literacy, but only in one (Digital Content Creation), therefore we cannot accept the alternative hypothesis 3H1 (we reject it) and accept the null hypothesis 3H0.

Table 18 Preconditions for the use of an appropriate test (3H)

	Normality Test Shapiro Wilk		Homogeneity Test Levene´s			
	W	p	F	df1	df2	p
DL	0.984	0.031	0.961	1	184	0.328
CC	0.927	<0.001	0.788	1	184	0.376
DC	0.939	<0.001	1.850	1	184	0.176
CS	0.967	0.003	0.445	1	184	0.506
PS	0.928	<0.001	0.018	1	184	0.893
Total	0.973	0.001	2.940	1	184	0.088

Source: own processing

Table 19 Descriptive statistics (3H)

	Descriptives					
	Group	N	M	MD	SD	SE
DL	Line Manager	106	64.2	63.5	15.1	1.47
	Employee – Specialist	80	64.7	64.0	14.3	1.60
CC	Line Manager	106	82.0	82.0	54.8	5.32
	Employee – Specialist	80	102.0	102.0	59.5	6.65
DC	Line Manager	106	418.0	418.0	122	11.9
	Employee – Specialist	80	447.0	447.0	114	12.7
CS	Line Manager	106	43.0	43.0	5.20	0.51
	Employee – Specialist	80	42.4	41.5	4.92	0.55
PS	Line Manager	106	10.5	10.0	2.40	0.23
	Employee – Specialist	80	10.5	10.0	2.40	0.27
Total	Line Manager	106	604	627.0	14.2	13.8
	Employee – Specialist	80	649	651.0	121	13.5

Source: own processing

Table 20 Mann Whitney U test results (3H)

	Mann Whitney U		
	Statistic	p	Effect size
DL	4169	0.423	0.017
CC	3779	0.103	0.109
DC	3493	0.020	0.176
CS	4240	0.500	0.0002
PS	4175	0.429	0.015
Total	3401	0.010	0.198

Source: own processing

Testing the statistical significance of hypothesis 4

Hypothesis 4 concerned the amount of time respondents spent on peer-to-peer education in each of the areas studied in relation to their job role. Again, the Independent Samples T-Test was used because the job position variable took only 2 values (line manager and employee – specialist). The results are presented in Tables 21, 22, 23. Again, we interpret only the overall result (number of hours of peer-to-peer training for all areas studied: line managers (n=106) did not spend more time (M=213, SD=26.1) on peer-to-peer education than employee-specialists (n=80), (M=212, SD=27.6). Difference (1) is not statistically significant (U=4005, p=0.741) with a trivial difference effect (Effect size=0.056). Again, there was no statistically significant difference for the individual areas examined, so we accept hypothesis 4H0 and reject hypothesis 4H1.

Table 21 Preconditions for the use of an appropriate test (4H)

	Normality Test Shapiro Wilk		Homogeneity Test Levene´s			
	W	p	F	df1	df2	p
DL	0.990	0.190	1.680	1	184	0.197
CC	0.961	<0.001	0.058	1	184	0.809
DC	0.949	<0.001	0.003	1	184	0.953
CS	0.983	0.022	0.051	1	184	0.821
PS	0.983	0.022	1.320	1	184	0.252
Total	0.946	<0.001		1	184	0.943

Source: own processing

Table 22 Descriptive statistics (4H)

	Descriptives					
	Group	N	M	MD	SD	SE
DL	Line Manager	106	24.3	24.0	4.46	0.433
	Employee – Specialist	80	24.5	25.0	4.93	0.551
CC	Line Manager	106	16.4	16.0	2.31	0.225
	Employee – Specialist	80	16.5	16.0	2.34	0.261
DC	Line Manager	106	108	103	24.7	2.400
	Employee – Specialist	80	107	103	27.1	3.030
CS	Line Manager	106	29.7	29.5	2.60	0.253
	Employee – Specialist	80	29.1	29.0	2.57	0.287
PS	Line Manager	106	34.9	35.0	3.94	0.383
	Employee – Specialist	80	34.3	34.0	3.35	0.375
Total	Line Manager	106	213	209	26.1	2.530
	Employee – Specialist	80	212	204	27.6	3.080

Source: own processing

Table 23 Mann Whitney U test results (4H)

	Mann Whitney U		
	Statistic	p	Effect size
DL	4071	0.321	0.040
CC	4189	0.444	0.012
DC	4068	0.682	0.041
CS	3753	0.912	0.115
PS	3843	0.864	0.094
Total	4005	0.741	0.056

Source: own processing

Testing the statistical significance of hypothesis 5

The statistical significance of hypothesis 5 was tested by ANOVA test as the variable characterizing the digital literacy areas took 5 different values. After testing the normality of data distribution (Shapiro-Wilk test) and Homogeneity of variances (Levene's test), we found that in both cases the $p < 0.01$, that is, the data are not normally distributed, therefore, it is necessary to subsequently use the non-parametric Kruskal-Wallis test. The results are presented in Table 24 and Table 25.

Table 24 Kruskal-Wallis test results

	χ^2	df	p	ε^2
Number of hours of self-education	762	4	<0.001	0.821

Source: own processing

Table 25 ANOVA test results (descriptive statistics)

Area	N	Mean	SD	SE
DL	186	64.4	14.74	1.081
CC	186	92.3	56.98	4.178
DC	186	413.6	119.5	8.762
CS	186	42.3	5.70	0.372
PS	186	10.5	2.39	0.176

Source: own processing

Interpretation of the results: there is a statistically significant difference between the five groups of digital literacy areas (according to our research model) in the variable number of hours of self-education. The Kruskal-Wallis test was statistically significant X^2 (4) = 762; $p < 0.01$, with a high effect size for the difference between groups, Eta = 0.82. Respondents spent the most time on self-education in the area of Digital Content Creation.

In this case, a statistically significant difference was demonstrated in the high strength of the relationship, Eta = 0.82. Therefore, we accept hypothesis 4H1 and reject hypothesis 4H0.

5 Conclusion

The aim of this paper was to highlight the importance of different areas of education in the development of digital knowledge and skills and to recommend preferred forms of education in each area of digital literacy. The results of our research showed that self-education, followed by peer-to-peer education and organized learning were the most preferred for our respondents, with only minimal use of specific variables such as implementing online marketing, using MS Excel, technical problem solving and creative use of digital technologies.

Based on the statistical testing of the hypotheses, we find that neither the number of hours of self-education nor peer to peer education differ based on initial education or job position. However, self-education differs statistically significantly across digital literacy content areas. Respondents spent the most time learning in the area of *Digital Content Creation*, from which learning in MS Excel proficiency stands out. They also devoted the most time to working in this program in the form of organized learning.

We did not statistically evaluate the level of improvement achieved by the training because the data were not suitable for statistical processing due to the highly individual and simultaneously different approaches and feelings of the respondents.

Our recommendations are directed towards education (Education 5.0) in the anticipated Industry 5.0 phase, in which the increasing demands for digital literacy are bringing new challenges. They affect almost all sectors and industries of the economy and at the same time place new demands on human resources. The basis of Education 5.0 is to focus primarily on requirements targeted at personalized learning and collaborative learning. A key idea in the process of education for the needs of employees is the development of highly adaptive learning using information and communication technologies. Our significant finding is the need for organized learning, which, based on empirical research, is minimally used. We propose to implement organized learning in all the researched areas, but especially in the areas of communication and collaboration, as well as cybersecurity, which were not used at all by the respondents in our research sample. We also cannot leave out self- and peer-to-peer education, as they form an important part of education according to each employee's own knowledge, skills and willpower (not only in the area of digital literacy).

In lifelong learning, we recognize the need for highly adaptive learning, which would need to be delivered through hybrid forms of learning. Hybrid forms of learning require further elaboration and experimental testing in providing multiple learning tutors, which can serve as an idea for further research. A contribution in further corporate professional education would be the need to develop extraordinary forms of education that would be the result of collaboration between academia and business. Universities of different specializations should be more involved in the development of further education and allow for the study of older students with a focus on part-time studies.

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