The Level of Digital Skills of Mining Employees: Their Learning Needs and Interest in Personal Development

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Abstract: Mining professions in the Czech Republic are declining. As a result, employees must transition to alternative occupations. This study examines the current level of digital skills among these employees. Such competences are broadly relevant for future employment and personal contexts. The research also examines employees' motivation and interest in enhancing their digital skills while facing gradual layoffs. The aim is to identify both individual and collective developmental needs. By analysing the relationship between self-assessed digital competence and motivation to improve these skills, it is possible to identify employees with both low competence and low motivation. These individuals may require targeted career guidance. In 2025, a stratified random sample of 529 employees from a mining organisation was surveyed. The survey yielded the following key findings: Respondents' digital competence averaged 2.41 on a five-point scale, below the midpoint. The perceived need for digital training was higher, with a mean of 3.44. Interest in acquiring new skills averaged 3.80, while interest in further development averaged 3.83. The most significant barrier was health or age (mean = 3.19), followed by lack of support (mean = 3.02) and lack of time (mean = 2.99). Analyses indicated a positive saturating relationship between digital competence and educational need. There were also positive linear relationships between educational need and both interest in learning new skills and interest in skill development. The overall mean barrier index did not significantly predict educational need.

Keywords: Digital Skills, Adult Learning Needs, Barriers to Participation in Education, Interest in Learning, Mining Industry

1. Introduction

"*Digital skills are increasingly considered a basic requirement for a wide range of professions, not only in technology fields. From basic skills, such as the ability to work effectively with office applications and online tools, to advanced skills in programming, data analysis and cybersecurity. Digital skills open the door to new opportunities and career growth. The labour market is changing, and it is necessary to respond to the ongoing changes. New types of work and new skill requirements are rapidly increasing." (Government Office of the Czech Republic, 2024). Recent* research indicates that the changes occurring in this decade will be crucial for Europe's future competitiveness (Deleersnyder et al., 2022). By 2030, the 50–65 age group is projected to increase by 17% and constitute the primary workforce. Over 90% of all jobs will require at least basic digital skills, compared to approximately 54% today. The concept of digital skills, or competences, continues to evolve as technological advancements and rapid digital development continue. Professional organisations and policymakers are actively working to define these skills by establishing relevant standards and content. This effort has resulted in the creation of several general and specific frameworks for digital competences, the most prominent being the European Digital Competence Framework (DigComp), "*which describes what is needed to be digitally competent in today's society and supports the development of digital competence among individuals of all ages. It covers a wide range of skill levels, from basic to highly advanced, and offers a stable reference point in a rapidly evolving digital technological landscape. DigComp 3.0 is the fifth version of the framework.*" (European Commission, 2026). The fifth version, compared to the 2022 update, introduces revised wording for competence areas and competences, updated proficiency levels, new learning outcomes, and the integration of AI competence.

The need to update general frameworks for digital competences is highlighted by findings that "over nine in ten (92%) workers in the EU used digital technologies in their work in 2024–2025 and 30% of EU workers used AI systems at work in the same year. In 2024, 42% of EU workers reported an AI skills gap, yet only 15% had participated in AI skills training" (Cosgrove and Cachia, 2025, p. 5).

The DigComp framework promotes a shared and common understanding of digital competence – knowledge, skills, and attitudes for the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It is used by a large majority of EU Member States and beyond, as well as at European and international levels, to inform policymaking; develop assessments; enhance transparency or comparability of education and training courses; recognise or validate learning (such as through digital skills certification); and define profiles of digital competence in specific jobs or roles (Cosgrove and Cachia,

2025). The framework consists of five areas: 1) information search, evaluation, and management; 2) communication and collaboration; 3) content creation; 4) safety, wellbeing and responsible use; and 5) problem identification and solving. Competences in the above areas can be developed up to four levels according to the framework: basic, intermediate, advanced, and highly advanced. At the basic level, individuals remember and implement simple tasks with guidance as needed. At the intermediate level, individuals identify and implement well-defined tasks and solve well-defined problems autonomously. We assume that respondents to our research will be equipped with digital competences mostly at the first level, which, among other things, assumes skills in using communication and collaboration software, word processing, spreadsheets and presentation software. The items of the employee questionnaire used focused on these skills. Within general digital frameworks, concepts such as digital rights, digital inclusion, and digital resilience have been outlined in response to rapid change. The digital rights of EU citizens appear in the European Declaration on Digital Rights and Principles for the Digital Decade (European Commission, 2023). This declaration presents 26 key points on the significance and functions of digital technologies, along with their opportunities and risks. Point 2 states, "*the digital transformation should contribute to a fair and inclusive society and economy in the EU*." Article 4 affirms everyone's right to education, training, and lifelong learning, including the right to acquire all digital skills. Articles 5 and 6, under Fair and Just Working Conditions, emphasise that "*trade unions and employers' organisations play an important role in the digital transformation, particularly in relation to the definition of fair and just working conditions, including with regard to the use of digital tools at work." These articles highlight the new idea of (digital) "Solidarity and inclusion*" (European Commission, 2023).

A subject of interest to experts and politicians is security and the management of personal and corporate risks associated with the use of the Internet and other digital tools and services. "*Resilience can be defined as 'a process to harness resources to sustain wellbeing', and digital resilience as the application of this concept to technology, the Internet, and the digital age. Digital resilience helps individuals recognise and manage the risks they encounter when socialising, exploring, or working online. It is achieved primarily through experience, rather than learning, and it is fostered by opportunities to confide in trusted others and later reflect upon online challenge*" (UK Council for Internet Safety, 2025).

Educational needs are defined as deficits or potential for the development of knowledge, skills, abilities, habits, or behaviours (Šeďová and Novotný, 2006). These needs are highly dynamic and variable, influenced by a range of interacting external and internal factors.

Educational need, understood as a deficit or potential for adult development, may pertain to individuals, groups, or larger social units (Průcha, 2014). For individuals, *"Educational needs of a subject are essentially states of experiencing and feeling the lack of something or the desirability of something that the subject lacks, which appears to them as a preference or ideal that can be achieved through some form of education"* (Palán, 2002, p. 37). This definition presumes individual awareness of the educational need. However, some individuals may be unaware that they lack the competences necessary for work, civic roles, or hobbies [10]. This perspective is further reflected in Prusáková's (2010, p. 17) definition: *"Educational needs arise as a hypothetical state (conscious or unconscious) when an individual lacks knowledge or skills that are important for his or her continued existence, the preservation of psychological, physical or social functions."* The typology of educational needs can be based on more than ten criteria (Malach, 2024). In this research, organisational (corporate) educational needs related to the number of individuals were considered, as well as professional needs focusing on educational areas. Additional considerations included the localisation of stimuli triggered by external needs, subjective needs from the subject–object criterion, stages of analysis of educational needs, types of educational need (as key competence), possibility of satisfaction, realisation status, type of need (deficit or potential as proactive), and urgency (non-urgent, satisfiable over a longer period).

Adult participation in education is often limited, restricted, or entirely prevented by various adverse circumstances, which are traditionally categorised as dispositional, institutional, and situational barriers (Kalenda et al., 2024). Dispositional barriers stem from adults' learning, educational, and life experiences and needs, manifesting as concerns about participation, doubts regarding the value of continued education after initial schooling, or low self-efficacy. Institutional barriers are obstacles encountered by education providers, including perceptions of the availability and quality of educational opportunities, as well as awareness of the education market. Situational barriers are directly related to individuals' life circumstances and may prevent participation even when opportunities exist or are known. These typically include lack of time, family obligations, insufficient employer support (such as not permitting education during working hours), and lack of financial resources.

The issue of determining the level of educational needs was the subject of the international project Needs of Adult Education Stakeholders, for which the research team developed and verified the research tool *Adult Education Needs Inventory* (AENI) (Ślósarz et al., 2022). In a group of 210 randomly selected participants, they determined the level of 9 skill groups, including digital ones. The average value of digital skills compared to the other five skills was the highest on a five-point scale, at 3.94, and was even higher than the average value (3.65) of all 39 AENI items. In relation to the partial objectives of the REFRESH project, which monitor the mutual connections between the education of adult employees of the closing coal industry and their children, the current results of the *International Computer and Information Literacy Survey* (ICILS) for the Czech Republic are also relevant; the following findings can be considered relevant to the project (Halbová et al., 2024): a) the average result of the Czech Republic in computer and information literacy was 525 points and was the highest average result among EU countries, b) computer and information literacy was related to the socio-economic background of the pupils, with disadvantaged pupils achieving an average result 64 points lower (i.e. three quarters of the skill level) on the computer and information literacy test, c) pupils from households with two or more computers scored approximately two-fifths of a skill level higher than pupils with one or no computer in the household in the computer and information literacy test, d) more pupils learn about using the Internet outside of school than in school, and e) 65% of 8th-grade pupils have no restrictions from their parents on screen time on school days, compared to an EU average of 60%.

2. Research

2.1 Research Problem and Goals

The research problem of the study is the lack of empirical data on the level of digital skills of a specific professional group in the context of its functioning during the period of decline of the industrial sector, and on the degree of their interest in further improving these skills, which would stimulate personal or systemic retraining activities. At the same time, the most significant barriers to employees' participation in further education are unknown. The aim of the research was to determine the level of digital skills of workers in mining professions in a representative sample, to determine the level of their need for digital education and their self-assessment of their readiness to learn new skills and develop their personal abilities, and to identify their potential problems (barriers) associated with their possible participation in this education.

2.2 Research Questions, Variables, and Hypotheses

For clarity and due to the limited scope, research questions (RQs) are always listed with the relevant results, which operate within defined variables and hypotheses formulated on their basis.

2.3 Methods

Data collection was conducted through a questionnaire survey. For the purposes of this study, the following selected items from the comprehensive questionnaire administered to mining employees were utilised:

- 4 items for the variable “subjectively assessed digital skills” and 4 items for the variable “subjectively declared level of educational needs” from the *SIW-Skills Inventory Worksheet* (2024). The inventory is internally structured, with 81 items that identify educational needs across 9 competences or skills.
- *10 items from the Barriers to Participation in Education Questionnaire, based on* the results of European monitoring using a five-point scale (European Commission, 2019).
- *2 items from the Czech version of the Career Adapt-Abilities Scale-Czech Form* (CAAS-Czech) (Hlaďo et al., 2020; Hlaďo and Kvasková, 2020).

The comprehensive research tool was approved by the University's Research Ethics Committee, and respondents participated in the research after being familiarised with the study and providing informed consent to participate.

2.4 Sample

The research group was a representative stratified sample of employees of a mining organisation, with respect to the division into labourers and technical-operatives, age structure, and gender. It consisted of 529 respondents.

2.5 Data Collection

Data collection took place between December 2024 and June 2025 through a survey organisation qualified to conduct research and marketing surveys.

2.6 Data Analysis

Data were analysed in R 4.3.3 (R Core Team, 2024). Digital competence and need for digital training were computed as mean indices from four 1–5 Likert items each; interest in learning new skills and interest in further development were assessed using two single-item 1–5 measures. Barriers to participation (10 items, 1–5) were analysed both at the item level and as 0–100 composite indices: an overall barrier index (mean of all 10 items) and two subscales separating personal/resource barriers (items 01–05) from course-access barriers (items 06–10).

Descriptive statistics were reported first. Associations were tested using Pearson and Spearman correlations and OLS regression. For the competence–need link, potential non-linearity was examined by adding a quadratic term and comparing model fit using AIC. For an interpretable cross-tabulation, competence and need were dichotomised using a median split, and the 2×2 association was evaluated using the χ^2 or Fisher's exact test, reporting the odds ratio with 95% CI. Associations between need and the two motivation items were tested with correlations and OLS. For barrier items, p-values were adjusted for multiple testing using BH-FDR (10 tests); $\alpha = 0.050$.

3. Results

The research results are presented in accordance with the research questions formulated above.

3.1 Descriptive Statistics (RQ1–RQ4)

Overall, *digital competence* was below the scale midpoint, with a mean of 2.41 (SD = 1.02) and a median of 2.25 (IQR = 1.25) on the 1–5 scale (N = 529) (Fig. 1). In contrast, the *need for digital training* was higher, with a mean of 3.44 (SD = 1.17) and a median of 3.75 (IQR = 1.50) (N = 528, NA = 1) (Fig. 2).

Both learning motivation indicators were high: *interest in learning new skills* had a mean of 3.80 (SD = 0.924, median = 4, IQR = 1.00; N = 528, NA = 1) (Fig. 3) and *interest in further development* had a mean of 3.83 (SD = 0.909, median = 4, IQR = 1.00; N = 528, NA = 1) (Fig. 4). The binned distributions showed that competence scores were concentrated in the lower-to-mid range, whereas need scores were concentrated in the mid-to-upper range, consistent with the descriptive summaries. The two interest items were skewed toward higher responses (4–5).

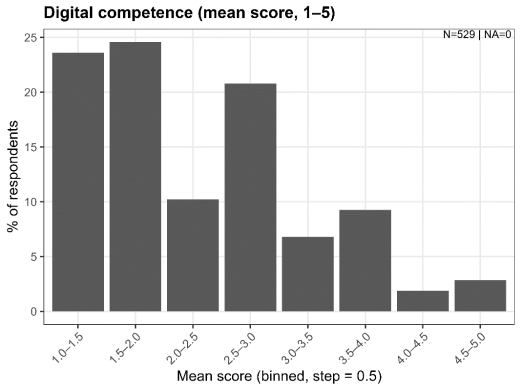


Figure 1: Digital competence (mean score, 1–5). Distribution of the digital competence index (mean of 4 items), shown as the percentage of respondents in 0.5-wide score bins. N and the number of missing values (NA) are indicated in the panel.

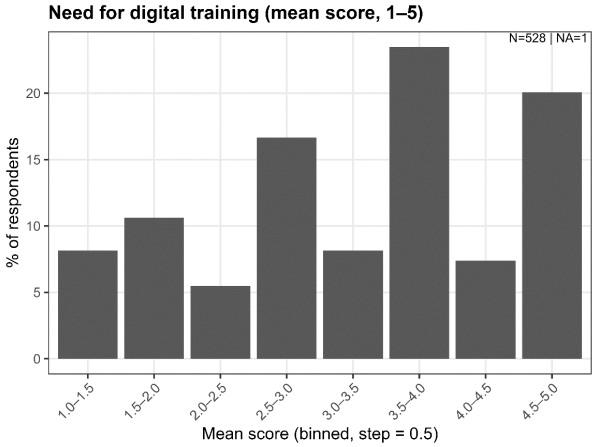


Figure 2: Need for digital training (mean score, 1–5). Distribution of the need-for-training index (mean of 4 items), shown as the percentage of respondents in 0.5-wide score bins. N and NA are indicated in the panel.

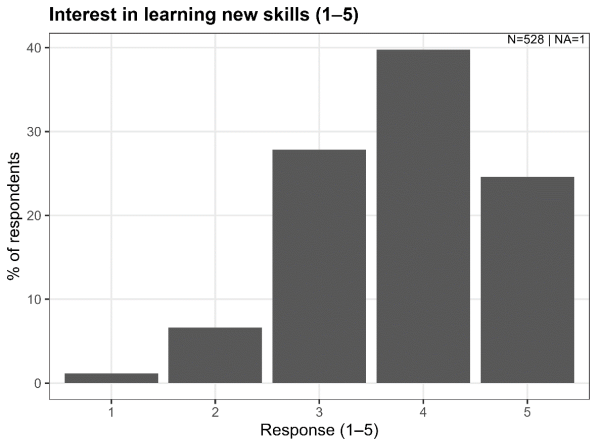


Figure 3: Interest in learning new skills (1–5). Distribution of responses to the single-item measure of interest in learning new skills, shown as the percentage of respondents selecting each response category (1–5). N and NA are indicated in the panel.

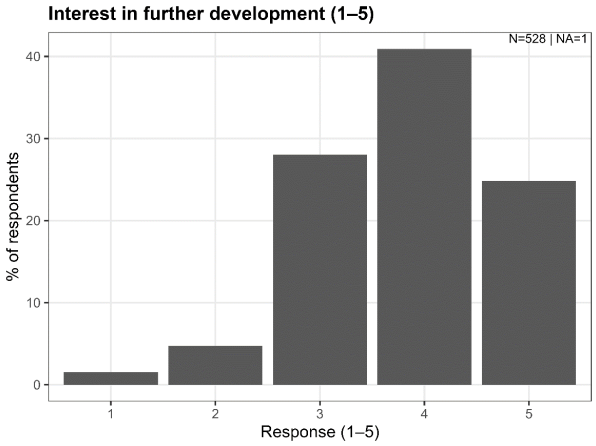


Figure 4: Interest in further development (1–5). Distribution of responses to the single-item measure of interest in further development, shown as the percentage of respondents selecting each response category (1–5). N and NA are indicated in the panel.

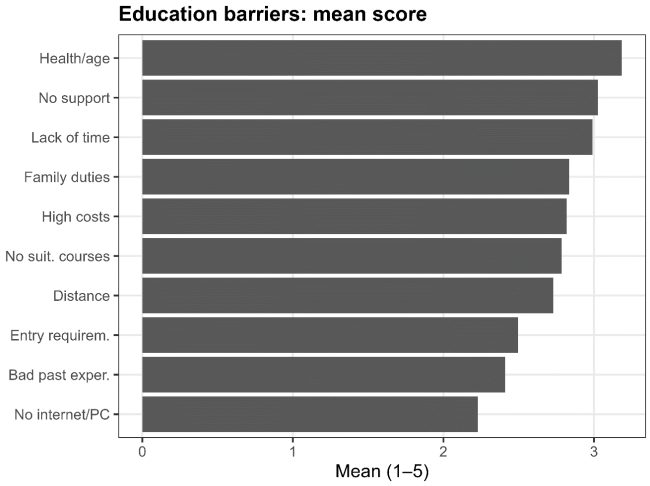


Figure 5: Ranking of barrier items by mean Likert score (1–5). Higher values indicate stronger perceived barriers.

In addition to the item-level ranking in Fig. 5, barriers were also summarised as 0–100 indices, which showed a mean overall barrier score of 43.8 ± 16.6 (median 42.5, IQR 22.5, range 0–95, n = 529), with two subscales: personal/resource barriers (items 01–05) 49.3 ± 18.3 (median 50, IQR 20, range 0–100), and course access/availability barriers (06–10) 38.2 ± 20.1 (median 35, IQR 25, range 0–100).

At the item level (1–5), the highest mean barrier was Health/age (item 04; mean = 3.19), followed by No support (05; mean = 3.02) and Lack of time (02; mean = 2.99). The lowest mean barrier was No internet/PC (08; mean = 2.23). When focusing on the proportion of "high barrier" responses (4–5), Health/age was most frequently endorsed (39.9%), followed by Lack of time (33.1%) and No support (32.9%). The lowest "high barrier" endorsement rates were observed for No internet/PC, Bad past experience, and Entry requirements (each 16.3%).

3.2 Association Analyses (RQ 5 – RQ 8)

3.2.1 Main Association Between Competence and Need (RQ5)

Digital competence was positively associated with the need for digital training (Pearson r = 0.397, 95% CI [0.323, 0.467], $p < 0.001$; Spearman ρ = 0.415, $p < 0.001$; N = 528) (Fig. 6). In a quadratic regression, need for digital training showed a non-linear association with digital competence: need increased with competence, but the increase levelled off at higher competence (negative quadratic component: $t = -5.083$, $p < 0.001$). The quadratic model fitted the data better than the linear model (ΔAIC = 23.36) and explained 19.7% of the variance ($R^2 = 0.197$; $F(2, 525) = 64.57$, $p < 0.001$).

Using median splits (competence median = 2.25; need median = 3.75), the most frequent quadrant was high competence / high need (33.3%), followed by low competence / low need (30.5%), while the two discordant groups (low competence / high need and high competence / low need) represented 17.6% and 18.6% of respondents, respectively. Quadrant frequencies differed from an equal 25% distribution ($\chi^2(3) = 41.318$, $p < 0.001$). The 2×2 table (Fig. 7) indicated a strong association between competence category and need category ($\chi^2(1) = 39.137$, $p < 0.001$; Fisher's exact $p < 0.001$), with higher competence linked to higher odds of high need (odds ratio = 3.102, 95% CI [2.146, 4.507]).

These results were consistent with hypothesis H1, which predicted a positive relationship between the subjectively assessed level of digital competences and the subjectively reported level of these educational needs among mining employees.

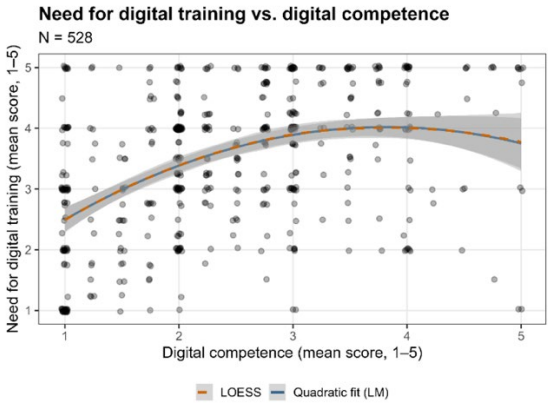


Figure 6: Need for digital training vs. digital competence. Scatterplot of individual respondents (jittered) with a quadratic regression fit (solid line) and 95% confidence band; a LOESS smoother (dashed line) is shown for visual assessment of potential non-linearity. Axes show mean indices (1–5).

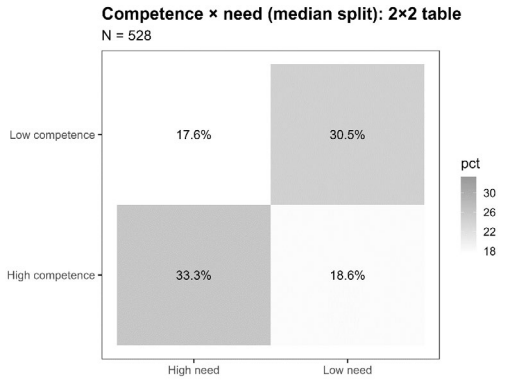


Figure 7: Competence × need (median split): 2×2 table. Heatmap of cell percentages for high/low competence by high/low need, based on median splits (N = 528).

3.2.2 Need for Training vs. Interest in Learning New Skills (RQ 6.1)

Need for digital training increased with interest in learning new skills (N = 527; Pearson r = 0.219, p < 0.001; Spearman ρ = 0.220, p < 0.001); the OLS slope was β = 0.278 (95% CI [0.172, 0.384], p < 0.001; R^2 = 0.048) (Fig. 8).

These results were consistent with hypothesis H2.1, which assumed a positive relationship between the subjectively reported level of educational needs of mining employees in digital competences and their self-assessment of interest in learning new skills.

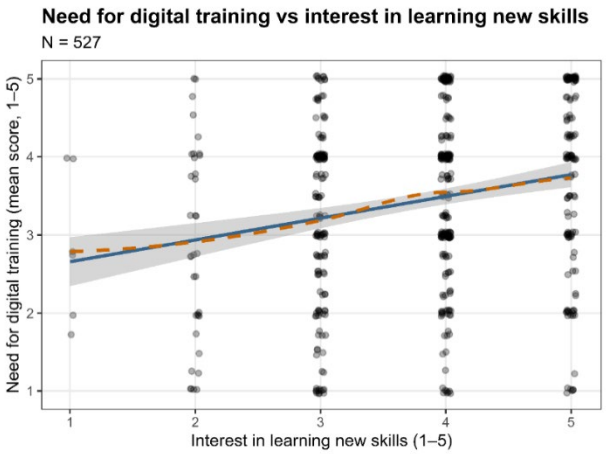


Figure 8: Need for digital training vs. interest in learning new skills. Jittered raw observations (N = 527) with an OLS regression line and 95% confidence band; LOESS (dashed) is shown as an exploratory smoother.

3.2.3 Need for Training vs. Developing One's Own Abilities (RQ 6.2)

Need for digital training also increased with interest in developing one's own abilities (N = 527; Pearson r = 0.251, p < 0.001; Spearman ρ = 0.249, p < 0.001). The OLS slope was β = 0.324 (95% CI [0.217, 0.431], p < 0.001; R^2 = 0.063), indicating a slightly stronger association than for learning new skills (Fig. 9).

These results were consistent with hypothesis H2, which predicted a positive association between need for digital training and interest in developing one's abilities.

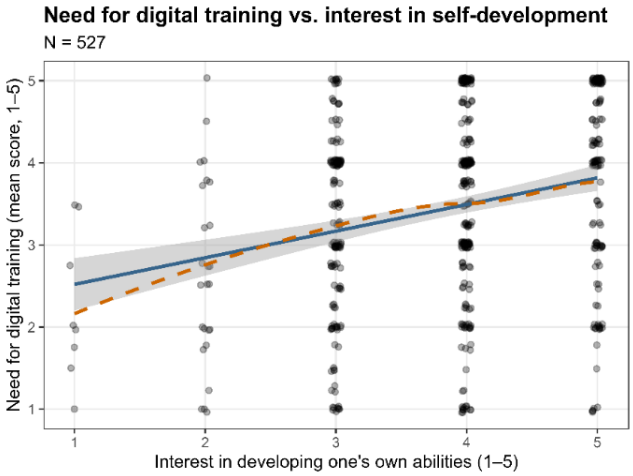


Figure 9: Need for digital training vs. interest in developing one's own abilities. Jittered raw observations (N = 527) with an OLS regression line and 95% confidence band; LOESS (dashed) is shown as an exploratory smoother.

3.2.4 Educational Needs vs. Educational Barriers (RQ 7)

Three barrier items showed the strongest (negative) associations with need after FDR correction: Bad past experiences (ρ = −0.185, p_FDR < 0.001), No internet/PC (ρ = −0.170, p_FDR < 0.001), and Entry requirements (ρ = −0.158, p_FDR < 0.001; N = 528). The remaining items were weak and not FDR-significant (Fig. 10).

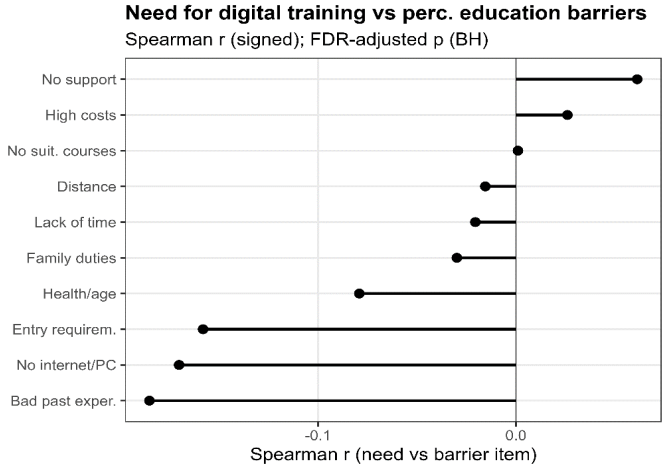


Figure 10: Need for digital training vs. perceived educational barriers (item-level). Lollipop plot shows signed Spearman correlations; p-values are FDR-adjusted (BH).

For barrier indices, the overall mean barrier index was not a significant predictor of need (b = −0.005, p = 0.080; R^2 = 0.006). The Personal/resource subscale showed no association (b ≈ 0.000, p = 0.901; R^2 ≈ 0.000). The course-access subscale showed a small negative association (b = −0.007, 95% CI [−0.012, −0.002], p = 0.005; R^2 = 0.015; N = 528).

Overall, H3 was not supported in the expected direction: the overall barrier index did not predict need, while only a few specific barriers (and the course-access subscale) showed small negative associations with need.

4. Conclusion

The study contributes empirical data to the theory of the development of digital skills of adults and to the andragogical context for their further development. The results provide a basis for educational practice in designing educational offerings that ensure the development of digital skills of adults, including the skills of parents who simultaneously influence the formation of digital competences of their children.

5. Discussion

The study's limitations include the use of only four items to measure digital skills, which does not sufficiently capture the breadth of the DigComp 3.0 framework (2025). The research plan assessed digital skills as one component within a broader evaluation of professional skills across nine areas, which constrained the inclusion of additional items specific to digital skills. Future studies will examine digital skill levels in greater detail alongside the other eight surveyed competences. A stratified random sample of 529 employees from a mining organisation was surveyed in 2025, yielding several key findings. Respondents demonstrated relatively low digital competence, with a mean score of 2.41 on a five-point scale. The perceived need for digital training was higher, with a mean of 3.44. Mean interest in learning new skills was 3.80, and mean interest in further development was 3.83. The most significant barriers were health or age (mean = 3.19), lack of support (mean = 3.02), and lack of time (mean = 2.99). The hypothesis of a positive relationship between digital competence and educational need was confirmed, aligning with previous research indicating that higher levels of formal education are associated with greater interest in further professional education. Conversely, adults with lower levels of formal education are less likely to participate in informal or corporate education. The hypotheses linking educational needs to interest in learning new skills and developing personal abilities were also supported. The overall mean barrier index did not significantly predict educational need.

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Ethics Declaration

We did not need ethical clearance for the research referred to in this paper.

AI Declaration

We did not use an artificial intelligence tool to create this article.

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