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DIGITAL INFORMAL LEARNING AND THE FUTURE WORKFORCE: CROSS-REGIONAL EVIDENCE

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Abstract: *In today's dynamic economic environment, the competitiveness of firms and economies depends on the continuous development of their workforce. Informal learning represents a vital yet often underestimated element of this process, shaping graduate lifelong learning, reskilling, and upskilling. This paper examines the informal learning sources of university business students in Europe, focusing on the Czech Republic (Czechia) as a representative of Central Europe, and complements the analysis with evidence from the Republic of China (Taiwan) as a comparative case from Asia. The aim is to identify which informal learning sources are most frequently used by business students and how these preferences compare with the European Union average, as reported by the Adult Education Survey (AES), to assess their implications for lifelong learning, reskilling, and upskilling. The study applies a mixed-methods approach, combining the most recent AES data with primary evidence from a pilot survey conducted in 2025 among 214 undergraduate business students in Czechia and Taiwan. The survey followed the European Commission's classification of informal learning activities and examined five categories: family, friends, and colleagues; electronic devices; printed materials; visiting educational places; and educational centres. The results indicate that Czech students rely primarily on electronic devices (91.2%) and peer networks (76.0%), while Taiwanese students combine digital resources (84.3%) and family, friends, and colleagues (84.3%) with stronger use of educational centres (49.4%) and guided tours (43.8%). In contrast, EU data highlight the continued importance of printed materials (54.6%). The study concludes that informal learning is not merely a supplement to formal training but an important foundation for building adaptable workforces. By linking European-level statistics with survey-based evidence, it contributes to understanding how universities and policymakers can design strategies that strengthen digital learning and AI-supported tools to prepare students for rapidly changing, technology-driven economies and sustainable growth in the future.*

Keywords: *business students, European Union, Taiwan, Czechia, learning source*

JEL classification: *J24, M53, O15*

INTRODUCTION

In the current era marked by rapid technological advancements and shifting labour market demands, the significance of upskilling and reskilling has become increasingly pronounced (European Commission, 2024). New employees´ skills are required based on technological progress such as artificial intelligence, automation and robotisation (European Centre for the Development of Vocational Training, 2024; Murrar et al., 2022). The coronavirus pandemic has opened up many new challenges and has affected corporate training and formal education (Rosenbaum et al., 2021), and reskilling and upskilling trends (Itam & Warrier, 2024). These disruptions underline the importance of lifelong learning, as emphasised by the European Union Council in the Skills Pact initiative, which aims to enhance the competencies of over 25 million adults by 2030 (European Commission, 2024). Consequently, adopting a skills-oriented approach has become vital for organisations worldwide, particularly in prioritising the reskilling and upskilling of their workforce (World Economic Forum, 2024) (Novaković et al., 2025).

For tertiary graduates, the need for continuous upskilling and reskilling is particularly important in nowadays job market. The necessity for continuous skill enhancement is underscored by several factors, including the changing nature of work, the impact of technological advancements, and the need for improved employability (Schultheiss et al., 2023). The future of work requires individuals to possess a multifaceted skill set, encompassing technological, cognitive, and social competencies, which are critical for navigating contemporary challenges (Achoki, 2023). Graduates who actively engage in upskilling are better prepared to address these challenges, ensuring their relevance and competitiveness in the workforce (Bikar et al., 2023).

The problem this paper addresses is the lack of attention paid to informal learning sources influencing habits and competencies necessary for lifelong learning. The foundation for continuous development is often established during university studies, particularly through informal and non-formal practices (Agić et al., 2022; Kulaš Mirosavljević et al., 2023). Economics students, as the future labour force, provide valuable insights for employers what learning behaviours could shape readiness for reskilling and upskilling of young professionals in the future.

This study aims to analyse informal learning sources utilised by economics-related university students in two different contexts – Czechia, representing Central and Eastern Europe, and Republic of China, called Taiwan or Chinese Taipei, representing Asia, both small countries with similar interests in innovation, research topics and technological development (DZS, 2025). These results are compared with the European Union (EU) data from the Adult Education Survey to capture broader trends in Europe and reveal their implications for lifelong learning, reskilling, and upskilling.

The motivation for undertaking this research lies in the fact that today's students represent tomorrow's workforce; understanding their learning preferences helps anticipate future challenges and opportunities in workforce development.

The following questions guide the research:

RQ1: Which informal learning sources are most frequently used by university business students in Czechia and Taiwan?

RQ2: How do these preferences compare with EU-level data, and what implications do the observed differences have for lifelong learning of future workforce?

The structure of the paper is as follows: Section 2 reviews the relevant literature on lifelong learning, reskilling, and informal education. Section 3 outlines the research methodology, including data sources and sample characteristics. Section 4 presents the empirical results from the pilot student survey and EU data. Section 5 discusses the findings considering existing literature and policy frameworks of EU. Finally, Section 6 summarises conclusions and outlines implications for future research and practice.

LITERATURE OVERVIEW

One of the key challenges facing European businesses and employers today is acquiring and developing employee competencies (Council Recommendation of 16 June 2022 on a European Approach to Micro-Credentials for Lifelong Learning and Employability 2022/C 243/02, 2022). In recent years, universities have played a more active role in employee training, complementing corporate initiatives to enhance workforce capabilities (Cumberland et al., 2023; Stoten, 2022). The skill-based approach is one of the recommended trends for higher competitiveness of business globally (World Economic Forum, 2024). Upskilling and reskilling have become standard practices in organizations to help manage skill gaps related to AI implementation (Cramarenco et al., 2023) and are part of lifelong learning including formal, non-formal and informal education and training (Johnson & Majewska, 2024).

Upskilling refers to the enhancement of an employee's existing skills, often by incorporating new competencies that improve performance within current roles. The World Economic Forum has projected that approximately 50% of all employees will require upskilling by 2025, emphasizing the urgency of this initiative across various industries (Lee et al., 2022). Beyond individual benefits, upskilling contributes to organizational competitiveness by attracting and retaining talent in high-turnover labour markets (Gamberini & Pluchino, 2024).

Reskilling, in contrast, focuses on equipping employees with entirely new skills required for transitioning into different job roles. This is particularly critical in industries where automation and artificial intelligence replace traditional jobs (Zhong & Juwaheer, 2024). Reskilling mitigates the adverse impacts of technological disruptions by enabling employees to adapt to emerging roles and responsibilities, especially in the case of artificial intelligence (Istudor et al., 2024). Artificial intelligence impacts employees in various ways, for instance in the banking industry (Nikolić, 2025) where many business graduates will be a future workforce.

In addition, university graduates should develop their skills also in context of their employability (Bikar et al., 2023). Graduates who actively pursue upskilling and reskilling opportunities are more likely to secure meaningful employment and achieve job satisfaction, as they can undertake more complex and rewarding tasks (Ramanathan et al., 2022). Integrating industry-relevant skills into educational programs is essential for preparing graduates for the workforce. Research indicates that many graduates express dissatisfaction with their skills training, suggesting a gap between academic preparation and industry expectations (Novaković et al., 2025) (Garden, 2023). Graduates can bridge this gap by participating in upskilling initiatives, gaining practical experience and competencies that align with market demands (Ramanathan et al., 2022). As Figure 1 illustrates, adults' skill development sources are diverse, encompassing formal, non-formal, and informal education pathways (Johnson & Majewska, 2024).

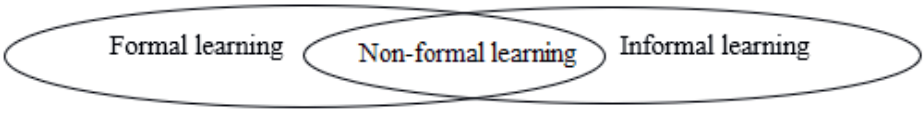

Figure 1: Interaction of formal, non-formal and informal learning in lifelong learning
Source: own elaboration based on Johnson & Majewska (2024)

1. Formal education is characterised by a structured curriculum, typically delivered in institutional settings such as schools and universities. It follows a systematic approach and often leads to recognised qualifications and certifications. This type of education is designed to impart specific knowledge and skills through a predetermined set of learning outcomes, which are assessed through standardised testing and evaluations (European Commission, 2016).

2. Non-formal education or non-formal training, on the other hand, refers to organised educational activities that occur outside the formal education system. This type of education is often more flexible and adaptive, catering to the needs of specific groups, such as marginalised communities or adults seeking to improve their skills. Typical non-formal learning activities include courses, workshops or seminars, guided on-the-job training, or private lessons (Eurostat, 2025a). For example, microlearning become one of modern tool for employee and competency development (Ostin, 2024). Non-formal learning and training is important for company competitiveness and as following Figure 2 shows in most European countries is sponsored by employers.

Figure 2: Participation of tertiary-educated young adults (18–24 years old) in job-related non-formal education and training in selected EU countries and EU-level data in 2022, in %
Source: own elaboration based on Eurostat, 2025b

Figure 2 presents the proportion of tertiary-educated young adults from 18 to 24 years old engaged in job-related non-formal education and training, distinguishing between activities sponsored by employers and those funded by other sources (not sponsored by the employer). On average in the EU, 29.9% of young adults participate in such activities, of which 21.2% are employer-sponsored. In Czechia the participation rate is only 17.4%, with 16.1% of activities funded by employers, placing the country significantly below the EU-level data (Eurostat, 2025c). In the Taiwanese context, non-formal education is also seen as a significant contributor to lifelong learning.

Research shows that Taiwan has developed a strong system of non-formal education, particularly in areas such as environmental and community learning, supported by both government and non-government organisations (Hsu, 2017). Non-formal education is mostly complemented by informal learning.

3. Informal learning refers to the learning that occurs outside of structured educational settings. This type of learning is often spontaneous and can take place in various contexts, including workplaces, social interactions, and community engagements. Informal learning encompasses a wide range of activities, such as peer learning, mentorship, self-directed study, and experiential learning, which contribute to skill development and knowledge acquisition without the constraints of formal curricula. Informal learning is often more flexible and can be tailored to employees' specific needs, allowing them to acquire new skills more personalised. Integrating digital technologies and platforms has further facilitated informal learning, enabling employees to access resources and training materials at their convenience (Morandini et al., 2023).

Informal learning encourages lifelong learning and adaptability, enabling graduates to acquire new skills and knowledge relevant to their careers continuously (Chisvert-Tarazona et al., 2019). Graduates might engage in informal learning by attending industry conferences or collaborating with peers on projects, all of which can enhance their professional competencies. Recent studies also highlight the role of online learning during the COVID-19 pandemic, which reinforced the reliance of students on digital and informal resources (Agić et al., 2022).

Informal learning can be categorised based on AES (Eurostat, 2025b) into five distinct sources, each contributing to the learning and skill development of individuals outside of structured educational settings:

1. Family member, friend or colleague: Informal learning often occurs through interactions with family members, friends, and colleagues. These relationships provide opportunities for knowledge sharing, mentorship, and peer learning. For instance, informal discussions about work-related challenges or sharing personal experiences can enhance understanding and skill acquisition. This type of training is characterised by its spontaneous nature and the personal connections that facilitate learning.

2. Electronic devices: The use of electronic devices, such as smartphones, tablets, and computers, has revolutionised informal learning. Individuals can access many information and learning resources online, including tutorials, webinars, and educational apps. This self-directed approach allows learners to tailor their training to their specific needs and interests, making it a valuable source of informal education. The flexibility offered by electronic devices enables learners to engage with content at their own pace and convenience.

3. Printed materials: Printed materials also belong to informal learning sources. Books, articles, and professional journals provide in-depth knowledge and insights into various fields. Individuals can enhance their understanding of specific topics or acquire new skills through self-study of these resources. The accessibility of printed materials allows learners to explore subjects that interest them, contributing to their overall professional development.

4. Guided tours of museums, historical, natural or industrial sites: Guided tours offer experiential learning opportunities. These tours provide context and background information that enrich the learning experience. Participants can engage with experts

and gain insights that may not be available through traditional educational channels. Such informal learning experiences can foster a deeper appreciation for cultural, historical, and scientific knowledge.

5. Visiting learning centres (including libraries): Libraries serve as vital educational centres, facilitating informal learning and providing access to a wide range of resources. They often host workshops, seminars, and community programs that promote learning and skill development. By leveraging the resources and services offered by libraries, individuals can enhance their knowledge and competencies in various fields.

To sum up, exploring trends in non-formal education and informal learning is important, as these are foundational for upskilling and reskilling, especially for tertiary-educated employees (Agarwal et al., 2022; Homayoun et al., 2024).

METHODOLOGY

The methodology applied in this study builds on a literature review and on both secondary and primary data sources. Secondary data were derived from the latest edition of the Adult Education Survey (AES) conducted by Eurostat in 2022, with published aggregated data in 2024. The AES is a harmonised survey that has been carried out regularly in most European countries since 2007, approximately every five years, and provides internationally comparable data on formal, non-formal, and informal education of adults aged from 18 to 69 years (Eurostat, 2025b). For this paper, the subgroup of tertiary-educated adults aged 18 to 24 years was most relevant to provide a benchmark for undergraduates.

The primary data stem from a pilot survey conducted in March and April 2025 among 214 undergraduate business students from a selected university in Czechia and a partner business university in Taiwan. Most of the respondents (96.7 %) were between 19 and 24 years old; only 7 respondents were slightly older. Table 1 reflects the gender profile of respondents.

Table 1. Respondent profile of pilot survey of undergraduates in Czechia and Taiwan.

Country	Woman	Man	Total	Percentage
Czechia	82	43	125	58.4 %
Taiwan	72	17	89	41.6 %

Source: own elaboration

The students were asked to indicate which sources of informal learning they use. The survey applied a structured questionnaire with closed questions based on the classification of informal learning sources used in AES (Eurostat, 2025b). These included: family, friends, and colleagues; electronic devices; printed materials; visiting educational places; educational centres; and cooperation with companies. For the conducting of the survey, the CAWI method through Google Form was applied. Respondents had the option to select more resources, as per the methodology of the AES. For data analysis, descriptive statistics were used. The methodological contribution of this paper lies in combining large-scale official data of AES published in 2024 with a focused pilot survey on business university students.

EMPIRICAL EVIDENCE

The empirical evidence for this study is based on two complementary sources of data, which together provide macro-level and micro-level insights into informal learning.

First, secondary data were obtained from the AES (Eurostat, 2025b), published and aggregated by Eurostat in 2024 and later. AES enables benchmarking of Czechia within the EU context and illustrates regional disparities in life learning engagement. Figure 3 presents a map of participation in informal education among tertiary-educated young adults across EU countries in 2022, clearly showing rates in Europe compared to Central, Eastern, and Southern regions, with Czechia (87.0%) slightly positioned above the EU-level data (84.5 %).

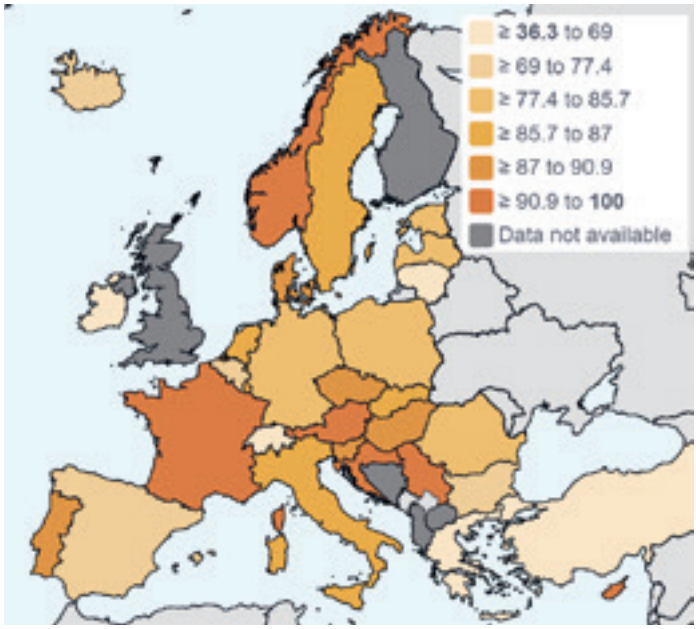

Figure 3: Participation of tertiary-educated young adults (18–24) in informal education across EU countries in 2022, in %

Source: Eurostat, 2024

Second, primary data were collected through a pilot survey. Figure 4 illustrates the comparison of informal sources selected by Czech and Taiwanese students and the EU-level data.

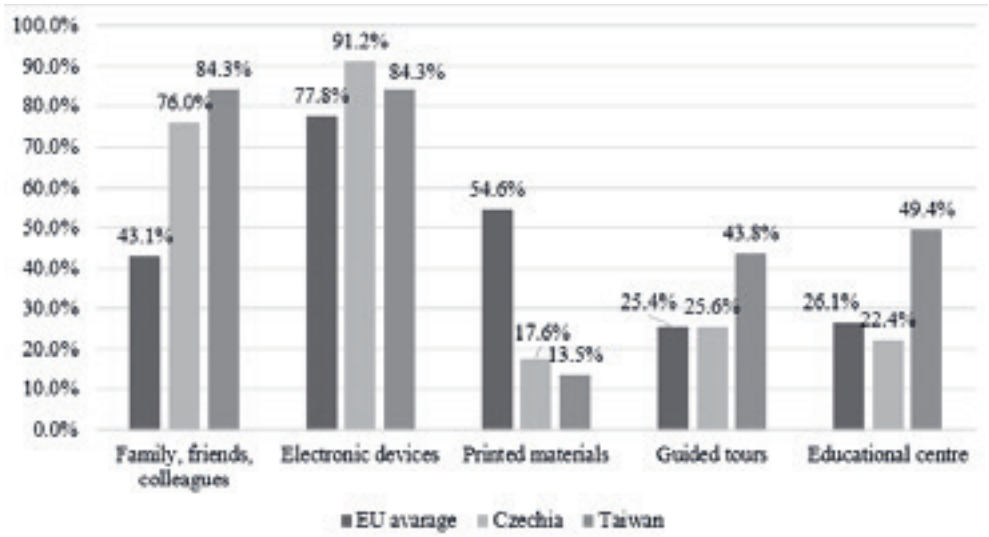

Figure 4: Sources of informal learning among business students in Czechia and Taiwan (pilot survey, 2025) compared with EU data (AES 2022, tertiary-educated, 18–24), in %

Source: own elaboration based on pilot survey data (2025) and Eurostat (2022)

Czech students show very high reliance on electronic devices (91.2%) and peer networks (76.0%), while Taiwanese students, although also digitally oriented (84.3%), use institutional resources such as educational centres (49.4%) and guided tours (43.8%) far more than Czech students. In contrast, the EU-level data demonstrates a strong reliance on printed materials (54.6%), which are less relevant for current business undergraduates in Czechia and Taiwan.

RESULTS AND DISCUSSION

The analysis of informal learning sources provides evidence of regional differences. Czech business students demonstrate a very high reliance on electronic devices and peer networks, whereas Taiwanese students, while also digitally oriented, show a broader mix of informal learning practices, including use of educational centres such as libraries or guided tours.

These findings highlight a shift towards digital learning, especially for the future workforce educated at universities. This aligns with previous research showing that younger cohorts increasingly favour technology-enabled learning (Morandini et al., 2023). The COVID-19 pandemic accelerated this transition, as Agić et al. (2022) demonstrated in their study of online learning, where both students and professors adjusted to digital modes of education

Compared to the EU-level data, which highlights, besides electronic devices (77.8%), printed materials (54.6%) and family, friends, and colleagues (43.1%) as key informal learning sources, students from Czechia and Taiwan demonstrate different learning patterns. Czech students show much higher reliance on electronic devices (91.2% vs. 77.8% EU) and peer networks (76.0% vs. 43.1% EU), while assigning only marginal importance to printed materials (17.6%). Taiwanese students, on the other hand, combine digital resources (84.3%) with greater use of institutional and expe-

riential sources such as educational centres (49.4% vs. 22.4% EU) and guided tours (43.8% vs. 25.4% EU). These findings suggest that the younger generation of university students diverges from the EU-level data by moving away from print-based learning and adopting more technology-driven and interactive forms of informal learning.

These results clearly reflect the broader context of lifelong learning and reskilling highlighted in the introduction. The EU-level data still emphasises more traditional, print-based forms of informal education. In contrast, the reliance of Czech and Taiwanese students on digital tools and peer learning underscores the shift described in recent literature, where younger cohorts increasingly favor technology-enabled and flexible learning modes (Agić et al., 2022; Morandini et al., 2023). This digital orientation aligns with current policy priorities such as the EU Skills Pact, which stresses the importance of preparing future employees for technological change (European Commission, 2024). As Nikolić (2025) notes, AI is reshaping employees in a selected industry, creating both opportunities and challenges for organisations.

Moreover, AI is expected to influence not only formal but also non-formal and informal learning by enabling adaptive and personalised learning pathways (Istudor et al., 2024). AI tools could further enhance Czech and Taiwanese students' informal learning practices, as they already show strong readiness for digital learning.

These insights suggest that universities and employers should recognise the informal and digital learning practices already adopted by students and integrate them more systematically into upskilling and reskilling strategies. Therefore, understanding how students incorporate digital tools into their learning is crucial for anticipating how future employees will adapt to AI-driven environments and how lifelong learning trends will evolve both in higher education and in corporate settings.

This study's limitations include the relatively small sample of 214 business students and the restricted scope of AES indicators. Nevertheless, by combining official large-scale survey data with pilot research, the study contributes valuable insights into how generational and regional differences shape informal learning behaviours. Future research should extend the analysis to more countries, studies and contexts to capture broader cultural and institutional variations. Applying more advanced statistical methods, such as structural equation modelling, would also allow for more robust testing of relationships between informal learning practices, employability, and digital readiness. In addition, longitudinal research would provide a deeper understanding of how these patterns evolve over time, particularly considering technological disruptions such as artificial intelligence.

Despite these limitations, the study presents novel and timely results that enrich the debate on lifelong learning and highlight the role of informal and digital education in preparing graduates for future labour market challenges.

CONCLUSION

This paper examined the informal learning sources of university business students in Czechia and Taiwan and compared them with EU-level data from the Adult Education Survey (AES). The results showed that Czech students relied most on electronic devices and peer networks, while Taiwanese students combined digital tools with stronger institutional sources, in contrast to the EU-level data of young tertiary-educated adults, who still showed considerable reliance on printed materials. The

study contributes by linking macro-level European statistics with micro-level pilot survey evidence, offering new insights into how educational level and regional differences shape informal learning and thus influence the adaptability of future workforces, providing one of the first cross-regional comparisons of informal learning at the intersection of Europe and Asia. Despite limitations such as the relatively small sample size and reliance only on AES indicators, the findings provide relevant implications for practice and policy: universities should strengthen digital learning to better match students' habits and prepare them for future labour market challenges. Future research should expand the analysis to additional countries, take into account more studies and apply a wider range of research tools. It would also be appropriate to examine more deeply the influence of artificial intelligence on formal, informal, and non-formal education. Overall, the study demonstrates that informal learning is not merely a supplement to formal training but an important driver of employability, competitiveness, and sustainable growth in rapidly changing economies.

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