International Journal of Lifelong Education

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/tled20

Online learning platforms and resources in adult education and training: new findings from four European countries

Tomáš Karger, Jan Kalenda, Jitka Vaculíková & Ilona Kočvarová

To cite this article: Tomáš Karger, Jan Kalenda, Jitka Vaculíková & Ilona Kočvarová (2024) Online learning platforms and resources in adult education and training: new findings from four European countries, International Journal of Lifelong Education, 43:4, 417-431, DOI: 10.1080/02601370.2024.2358896

To link to this article: https://doi.org/10.1080/02601370.2024.2358896

INTERNATIONAL JOURNAL OF LIFELONG EDUCATION
2024, VOL. 43, NO. 4, 417–431
https://doi.org/10.1080/02601370.2024.2358896

Online learning platforms and resources in adult education and training: new findings from four European countries

Tomáš Karger, Jan Kalenda, Jitka Vaculíková and Ilona Kočvarová

Faculty of Humanities, Research Centre of FHS, Tomas Bata University in Zlín, Zlín, Czech Republic

ABSTRACT

Digitisation represents one of the key directions of adult education and training in the post-COVID-19 times, but direct empirical evidence of its scope among learners is rather scarce after 2021. Therefore, the general aim of this article is to investigate the current state of the use of online learning platforms and resources in adult education and training throughout Europe. For this purpose, we utilise data from a dedicated survey in the Czech Republic, Germany, Sweden, and the United Kingdom ($n = 4{,}000$) from 2022, which cover a wide range of digitalisation as measured by the Digital Economy and Society Index (DESI). Our findings are consistent with DESI in the overall levels of online learning across the four countries. Beyond this, we provide two main findings. First, the patterns of digitalisation are different in formal (FAE) and non-formal adult education (NFE). We identify two corresponding modes of platformization based on how and how much online learning platforms and resources are used. Second, factors of participation in online learning differ in some regards from factors of participation in AET in general. Therefore, online learning seems to constitute a new layer mediating participation in AET, possibly introducing new forms of inequalities.

ARTICLE HISTORY
Received 18 December 2023
Accepted 17 May 2024

KEYWORDS
Adult education and training; platformization; digital inequality

Introduction

Digitisation of social life is one of the most profound social processes that change the nature of current societies (Castells, 2009; McAfee & Brynjolfsson, 2017). Part of this large-scale transformation is also a proliferation of online learning platforms and resources like YouTube, Coursera, LinkedIn, Masterclass, and many others that are utilised for both Non-formal Adult Education (NFE) and informal learning (Jones, 2015; Jütte & Wildemeersch, 2017). Digitisation has also impacted Formal Adult Education (FAE), leading to an increase in the use of online delivery methods (Gegenfurtner & Ebner, 2019; Gegenfurtner et al., 2020). This shift has been accelerated and reinforced by the COVID-19 pandemic, which normalised digitisation of learning (Agrawal et al., 2020; Herteis & Billett, 2023). Furthermore, many organisations have stuck with remote work after the end of the pandemic (ILO, 2022) and it is highly probable that this mode of AET delivery is more common than ever.

Direct empirical evidence of the scope of online learning among adults and its proportion on the total provision of AET, is rather scarce after 2021, as large-scale international surveys like the Adult

CONTACT Tomáš Karger karger@utb.cz Tomas Bata University in Zlín, nám. T. G. Masaryka 5555, Zlín 760 01, Czech Republic

Supplemental data for this article can be accessed online at https://doi.org/10.1080/02601370.2024.2358896

Education Survey (AES) by Eurostat and the Programme for the International Assessment of Adult Competencies (PIAAC) from OECD have been postponed. Therefore, this paper is intended to investigate the current state of the use of online learning platforms and resources in AET and show how much of organised adult learning provision is delivered through them.

For this purpose, we utilise data from a dedicated survey in the Czech Republic, Germany, Sweden, and the United Kingdom. These four countries were chosen for data collection because they cover a wide range of digitalisation. To gauge this, we use the Digital Economy and Society Index (DESI), which aggregates indicators of connectivity, human capital, use of internet services, integration of digital technology, and digital public services. According to DESI 2020 – which is the last one to include the UK – the four countries are evenly spread across the first 17 positions of the participating European countries, with Sweden having the 2nd highest index, the UK having 8th, Germany 12th, and the Czech Republic 17th (European Commission, 2020).

DESI 2020 is also the last year to include indicators of online learning in terms of participation in online courses and usage of online learning materials, which are drawn from the ICT Usage in Households and by Individuals survey. While this survey provides the most up-to-date information on the subject of this article (see Eurostat, 2024), it no longer encompasses the UK and fails to distinguish between FAE and NFE. Furthermore, it does not account for online learning materials downloaded by users, utilises a reference period of just three months, and does not permit an estimation of the proportion of online AET within the total volume of AET, which is crucial for the estimation of how much is the current AET digitalised. As a result, our findings are not directly comparable to the indicators provided by Eurostat. Instead, they are intended to align with the results from PIAAC and AES. Still, this component of the DESI 2020 represents a starting point for our investigation by ordering the four countries according to the percentage of internet users learning online in the following sequence: the UK (20%), Sweden (19%), Germany (9%), and Czechia (7%).

The main aim of this article is to compare the four selected countries in terms of usage of online learning platforms and resources and their factors. The main aim can be decomposed into two specific research aims (RA1–2) as follows:

RA1: To compare the usage of online learning platforms and resources in FAE and NFE across the four countries.

RA2: To identify and measure key macro (country, occupational status, and company size) and microsocial (gender, age, education, employment status, health status, and individual perception of educational opportunities reduced by the COVID-19 pandemic) factors of use of online learning platforms and resources in FAE and NFE.

In the following sections, we first elaborate on our conceptual framework that draws on research on platformization, participation in AET and digital inequality. This framework will help us to contextualise and interpret the usage rates and factors of online learning platforms and resources across the four countries, while comparing FAE and NFE. Second, we present our methodological approach, including details on the sample, research instrument, and variables for analysis. Third, we present data analysis, which is structured according to the research aims stated above. Finally, in the concluding section, we provide a discussion of findings, limitations and directions for future research.

Conceptual frameworks

The question of digitalisation of adult education and training is important for two reasons. First, because digitalisation transforms the nature of education itself, bringing in new stakeholders and repositioning the old ones. As platforms are currently the dominant organisational forms of digitalisation, we use the theory of platformization in order to unpack the mechanisms and consequences of digitalisation. Second, because digitalisation affects access to educational

opportunities and therefore influences educational inequalities in the adult population. This issue lies at the intersection of adult education participation theory and research on digital inequality, and we will tackle it in more detail below.

Platformization

The concept of platformization has been very influential in recent research on digital platforms. Its main proponents postulate that digital platforms – a new organisational form with distinct technological, economic and normative characteristics – are currently transforming whole societies as an increasing number of societal sectors become 'platformized' (Poell et al., 2019; van Dijck et al., 2018). A whole platform ecosystem is being established, spanning from essential information infrastructure to sophisticated specialised services (Plantin et al., 2018; van Dijck et al., 2018; van Dijck, 2021). Correspondingly, platforms are not to be seen as singular entities, but as complex conglomerates of interrelationships between a broad range of actors and artefacts (Nichols & Garcia, 2022). In this way, digital platforms represent intermediaries that cross boundaries between market/non-market sectors and between global and local environments (Kerssens & van Dijck, 2023). As a result, there are deep concerns over the fact that the information infrastructure increasingly used by educational institutions is owned and governed by private for-profit entities (Helberger et al., 2018; Kerssens & van Dijck, 2021; van Dijck, 2020).

The theory of platformization has worked out the mechanisms, which are present in the platformization process. First, *datafication* entails the ability of platforms to compile unprecedented datasets containing information on sociodemographic characteristics, locations, time, or user behaviour. Data represent an invaluable economic resource that is used to enhance various services, products, or production processes (Poell et al., 2019; Srnicek, 2017). Second, *commodification* represents the fact that through datafication, items or activities that have so far been irrelevant for economic markets acquire such relevance (van Dijck et al., 2018). In other words, mundane activities such as viewing or sharing something online are aggregated into dataset commodities and thus gain market value. Third, *selection* accounts for the fact that digital platforms pre-determine user actions by providing users with selected options in both interface and content. While algorithms pre-select the content displayed to users, interface source code pre-selects the actions users can take. This process of selection is circular as user selections are recorded and fed back to enhance algorithms and interface design (van Dijck et al., 2018). It could be argued that through selection, licencing agreements and API design, platforms *govern* not only their users but their wider surroundings (Poell et al., 2019). On the other hand, some authors suggest that users actively partake in the process of platformization by developing a range of *platform practices* (Duffy et al., 2019).

The research on digital platforms has been covering an increasingly wide array of sectors, where the transforming effects of digital platforms are present. These include healthcare (Williams et al., 2020), journalism (Poell et al., 2022), transportation (Dunn, 2020), science (da Silva Neto & Chiarini, 2023), or even the military (Hoijtink & Planqué van Hardeveld, 2022). One of the first sectors to be investigated with regard to platformization was education (van Dijck & Poell, 2015a, 2018; van Dijck et al., 2018). In this context, the mechanisms of platformization bring several issues including new concerns over privacy protection of students (van Dijck & Poell, 2015b, 2018; van Dijck et al., 2018), teachers and instructors increasingly in the roles of administrators and data managers (Cappello, 2022; Kumar et al., 2019), absence of collective experience or reflection in the learning process (Cone, 2023; Ideland, 2021; Pangrazio et al., 2022), or opaque determination of curriculum determined by business interests of platform companies (Hillman et al., 2020; Williamson & Komljenovic, 2022). However, the mechanisms of platformization and the issues it brings for the education sector will manifest in various countries with varying intensity. While Artopoulos (2023) already pointed to the gap between the 'early adopter' countries and countries from the Global South, the exact degree of pervasiveness of digital platforms among countries and across parts of their educational systems has scarcely been investigated.

Thus, by exploring the degree of use of digital platforms in AET, this article contributes concrete measures of pervasiveness of digital platforms in this area. In this regard, we attempt to measure the pervasiveness utilising several distinguishing categories. First, we compare the degree of platformization among the four selected countries, which differ in the degree of digitalisation as measured by DESI. Second, we measure the rate of platformization separately for FAE and NFE. Third, we differentiate full online delivery using any means (including general purpose tools such as videocalls and emails) from usage of platforms that are specifically tailored to learning (but that can also be used only to supplement face-to-face interaction). Fourth, we distinguish between platformization driven by educational institutions and platformization driven by individual learners. This last point is made possible by having separate survey questions for direct use of platforms in the learning process (which we assume is decided by educational institutions) and for use of online learning resources other than those provided by educators (which we assume are searched and retrieved on third-party platforms). By analysing the educational sectors of the selected countries through these categories, this article sheds light on where platformization has advanced, and thus where we can expect the mechanisms of platformization to be most at work.

Adult education participation and digital inequality

In addition to the platformization theory, our research aligns with contemporary investigations in the field of participation in AET (Boeren, 2016, 2023; Cabus et al., 2020; Desjardins & Ioannidou, 2020; Desjardins & Kim, 2023; Rubenson, 2018; Saar & Räis, 2017). These studies have introduced two distinct sets of variables that are scrutinised concerning their relationship with participation inequality in AET. Specifically, these variables encompass macrosocial factors, such as country of residence, occupational status, and company size (Desjardins, 2014; Roosmaa & Saar, 2012; Saar & Räis, 2017), as well as microsocial factors, including gender, age, education level, and employment status (Boeren, 2016, 2023).

In most instances, these factors are pivotal in explaining variations in AET participation, without distinguishing between online and offline delivery modes. Individuals residing in countries with stronger welfare systems, being employed, engaging in high-skilled occupations within larger firms, possessing higher educational qualifications, and falling within the middle-age demographic tend to have a higher likelihood of participating in AET (Boeren, 2016, 2023; Desjardins & Ioannidou, 2020; Desjardins & Kim, 2023; Rubenson, 2018). Therefore, our primary interest lies in examining whether these factors also *exert influence on the utilization of online learning platforms and resources in both FAE and NFE*.

Although the initial narrative of digitalisation has been one of improving accessibility and reducing inequalities (Benkler, 2011; Jenkins, 2013; Shirky, 2008), there is abundant research on the digital divide showing that accessibility of services that are provided in the digital form is hampered for certain segments of the population (Lythreatis et al., 2022; Scheerder et al., 2017). The disadvantaged segments are often defined by a similar set of microsocial sociodemographic characteristics as in the case of offline participation (see above) – i.e. age, highest attained education, socio-economic status, or place of residence.

There is an ongoing discussion about whether the digital divide introduces a new form of inequality or represents an extension of the existing ones (Lupač, 2018). Using empirical data from the UK, it has already been shown that the usual sociodemographic characteristics interfere with participation in online learning, even while controlling for factors such as digital skills and overall engagement with the Internet (Eynon & Malmberg, 2021). Another study from the UK by the same lead author suggests that digitalisation may create learning opportunities for certain categories of individuals in the disadvantaged segments, although the opportunities are to be found in informal learning rather than in formal education (Eynon & Helsper, 2011). This warrants further investigation into the factors

affecting online forms of learning also in non-formal education as a third category (see the definition of formal and non-formal education below), while extending the scope of investigation beyond the UK.

Additionally, we have incorporated two specific variables unique to our research: *health status* (indicating whether respondents have experienced serious health issues) and *educational opportunities* (signifying whether respondents' educational access was curtailed during the COVID-19 pandemic). As analysis by Roosmaa and Saar (2016) shown in the past, the health-related factors not only have a significant impact on the will to participate but also varied greatly between European countries. We hypothesise that these life experiences can significantly impact the usage of online learning platforms and resources, as individuals with such experiences are more likely to opt for online AET formats.

Method

Participants

The research sample comprised 4,000 adults, structured as a stratified quota sample of individuals aged 25 – 64 years, with 1,000 respondents (country citizens) from each participating country. The sampling was designed to reflect the representativeness of the adult population in key demographic characteristics such as age (across cohorts from 25 – 64 years), gender, region, participation in the labour market, and size of residence. However, it was not possible to achieve a representative distribution of educational attainment in the UK and Germany, where our samples exhibited a disproportionately higher number of adults with tertiary education (see Table S1. for further details, implications are reflected in Limitations below). Data collection was conducted by a professional agency in 2022 using the Computer Assisted Web Interviewing (CAWI) method. Throughout all stages of the survey process, strict adherence to ethical research principles was maintained, particularly concerning participant anonymity and compliance with the ICC/ESOMAR International Code (International Chamber of Commerce/ESOMAR, 2016). Informed consent was obtained from all participants.

Respondents were, on average, 50.2% females with age of 47.72 years ($SD = 11.28$). Almost half of them (49.3%) belonged to an age group of 25–44 years. Data on the highest attained educational level showed that 20.4% of participants achieved ISCED 3c or lower level of education, almost a third of participants (30.2%) achieved ISCED 3ab-4 and half of participants (49.4%) completed tertiary education (ISCED 5–8). The majority of participants were active in the labour market (75.8%) with full-time (56%) and high-skilled (39.9%) work position. Furthermore, most participants (67.6%) declared that they do not have any serious health problems affecting everyday life in the past year, and about the same proportion of participants (64.8%) confirmed that the COVID-19 pandemic did not considerably reduce their possibility to participate in education. The detailed socio-demographic distribution of the samples can be found in Supplementary Table 1.

Research instrument

The research presented here distinguishes between FAE and NFE, which were measured in accordance with the AES (Eurostat, 2018). AES defines FAE as education that is institutionalised, intentional and planned through public organisations and recognised private bodies and represents the formal education system of a country (UNESCO, 2011). NFE is defined as any further adult education outside the formal education system involving organised activities that do not result in official certification (UNESCO, 2011) and is typically covered by courses, workshops, seminars, and private lessons that are mainly personal or job-related. The reference period for both forms of education was twelve months prior to the survey.

The first dependent variable is based on asking respondents whether teaching was done on dedicated educational websites or portals (*online learning platforms*). The second dependent variable is based on a survey question inquiring, whether respondents used learning resources other than those provided by the educational institution that they obtained on the Internet (*online learning resources*). Both dependent variables were binomial (yes/no). In order to contextualise these two variables, there was also a survey question to account for whether most of the learning took place online or whether it took place in face-to-face contact with the instructor (*learning delivered online/offline*). This variable was also binomial.

Macrosocial independent variables were as follows: country, occupational status (utilising ISCO classification to distinguish high skills – ISCO 1–2, medium skills – ISCO 3–7 and low skills workers – ISCO 8–9), and company size (three categories: companies with more than 250 employees, 50 to 249 employees, and less than 50 employees). Microsocial independent variables included: gender, age, highest attained level of education, employment status (employed vs. out of the labour market due to e.g. retirement, maternity leave, unemployment), presence of serious health problems affecting everyday life in the past year, and experience with reduced educational opportunities caused by the COVID-19 pandemic.

Data analysis

Analysis for RA1 consists of descriptive statistics in the form of absolute and relative frequencies. In order to analyse the impact of key macro and microsocial factors (RA2), statistical modelling was used. More specifically, due to the binomial nature of the dependent variables (yes/no), a set of binary logistic regression models calculated by the Enter method were applied. We opted for a hierarchical approach to reflect the two levels of variables (macro and microsocial level). The first level only included macrosocial variables, while the second level included both, macro and microsocial independent variables. As we know that being employed or having active status in the labour market is one of the crucial preconditions for participation in AET (Boeren, 2016; Rubenson, 2018; Saar & Räis, 2017), we decided to conduct regression analysis separately for sample of all learners and sample of economically active respondents.

Results

RA1: To compare the usage of online learning platforms and resources in FAE and NFE across the four countries

The descriptive resuts of participation in adult learning (see Table 1) show that participation in NFE (48.7%) outperformed respondents' participation in FAE (18.3%) in all countries with Sweden reaching the highest rates of participation in both forms of learning compared to all

Table 1. Participation in different forms of learning divided by online and offline and used learning resources.

	Czech Republic	Germany	Sweden	United Kingdom	Average
Participation in learning			n (%)		
Participation in FAE	113 (11.3)	152 (15.2)	307 (30.7)	160 (16)	183 (18.3)
Share of learning delivered online	27 (23.9)	40 (26.3)	128 (41.7)	54 (33.8)	62 (31.4)
Share of learning delivered offline	86 (76.1)	112 (73.7)	179 (58.3)	106 (66.3)	121 (68.6)
Usage of online learning platforms	69 (61.1)	120 (78.9)	253 (82.4)	130 (81.3)	143 (75.9)
Usage of online learning resources	84 (74.3)	115 (75.7)	230 (74.9)	131 (81.9)	140 (76.7)
Participation in NFE	475 (47.5)	458 (45.8)	546 (54.6)	467 (46.7)	487 (48.7)
Share of learning delivered online	170 (35.8)	201 (43.9)	270 (49.5)	290 (62.1)	233 (47.8)
Share of learning delivered offline	305 (64.2)	257 (56.1)	276 (50.5)	177 (37.9)	254 (52.2)
Usage of online learning platforms	214 (45.1)	216 (47.2)	337 (61.7)	320 (68.5)	272 (55.6)
Usage of online learning resources	148 (31.2)	204 (44.5)	263 (48.2)	247 (52.9)	216 (44.2)

selected countries (54.6% in NFE, 30.7% in FAE). On average, the share of FAE delivered online (31.4%) was approximately half the FAE delivered offline (68.6%). The furthest outliers from the average are Sweden, in which the proportion of online (41.7%) and offline (58.3%) delivery is relatively balanced, and the Czech Republic, where most FAE are still delivered offline (76.1%). The usage of online learning platforms follows this ordering with Sweden (82.4%) having most platform usage and the Czech Republic (61.1%) having the least. Interesting in this regard is the usage of online learning resources by individual learners, where the differences across the four countries are minimised (spanning from 74.3% for the Czech Republic to 81.9% for the United Kingdom).

In NFE, there are even starker differences among the four countries. In the United Kingdom, online delivery is used for the majority of NFE (62.1%), in Sweden the proportion is balanced (49.5% and 50.5%, respectively) and in the other two countries, the majority of NFE is delivered offline, with the Czech Republic again having the smallest share of online delivery (35.8%). The same pattern can be found in usage of online platforms with the United Kingdom (68.5%) and Sweden (61.7%) having highest rates and Germany (47.2%) and the Czech Republic (45.1%) having the lowest. Interestingly, the levels of usage of online learning resources are substantially lower in NFE (average 44.2%), than in FAE (average 76.7%), and exhibit pronounced differences among the four countries (spanning from 31.2% for the Czech Republic to 52.9% for the United Kingdom) as opposed to FAE, where the usage of online learning resources shows minimal differences across countries.

RA2: To identify and measure key macro and microsocial factors of use of online learning platforms and resources in FAE and NFE

In the following section, we present findings through hierarchical regression models regarding the impact of macro and microsocial factors on the likelihood of use of online learning platforms and resources in FAE and NFE. Results are presented in models M1 – M8, in which M1 – M4 reflects FAE (M1 shows usage of online learning platforms among all learners and M2 among employed learners; M3 shows usage of online learning resources among all learners and M4 among employed learners). The same structure is repeated in models M5 – M8 for NFE. Table 2 summarises their quality parameters.

Table 2. Summary of quality parameters for models M1 – M8.

Model	Level	n	x^2	df	Sig.	Cox and Snell R^2	Nagelkerke R^2	Correctly classified cases (%)	Classification improvement (p.p.)
1	1	732	25.99	7	0.001	0.035	0.054	78.4	0.3
	2	732	45.46	15	<0.0005	0.060	0.093	78.6	0.5
2	1	579	29.44	7	<0.0005	0.050	0.078	79.1	0.0
	2	579	42.73	14	<0.0005	0.071	0.112	79.6	0.0
3	1	732	5.357	7	0.617	n/a	n/a	n/a	n/a
	2	732	44.58	15	<0.0005	0.059	0.089	76.8	0.3
4	1	579	3.742	7	0.809	n/a	n/a	n/a	n/a
	2	579	38.41	14	<0.0005	0.064	0.098	77.4	0.0
5	1	1,946	100.99	7	<0.0005	0.051	0.068	59.4	3.5
	2	1,946	157.73	15	<0.0005	0.078	0.104	64.1	8.2
6	1	1,693	95.52	7	<0.0005	0.055	0.074	60.4	3.6
	2	1,693	142.52	14	<0.0005	0.081	0.108	63.6	6.8
7	1	1,946	62.71	7	<0.0005	0.032	0.042	58.1	2.4
	2	1,946	165.29	15	<0.0005	0.081	0.109	63.4	7.7
8	1	1,693	60.01	7	<0.0005	0.035	0.047	58.8	2.5
	2	1,693	149.34	14	<0.0005	0.084	0.113	63.9	7.6

n = sample size included in the model; x^2 = chi-square statistic; df = degrees of freedom; Sig. = value of statistical significance; n/a = not available due to insufficient model quality.

Our interpretation of results is based on the values of odds ratios (Exp(B)) and statistical significance (Sig.), which are presented in Tables 3 and 4. The tables help us to assess how well our set of predictor variables explains the dependent variable, i.e. use of online learning platforms and resources, divided by inclusion of all learners and employed learners.

First, we present results regarding FAE (Table 3). In FAE, country is the strongest predictor of usage of online learning platforms in the case of all learners and employed learners. The model M1 also reveals that participants without serious health problems and reduced chance to be involved in education due to the COVID-19 pandemic had 1.7 and 1.5 times higher chance to use online learning platforms, compared to respondents with serious health problems and reduced educational opportunities.

Similar interpretation of individual variables can be seen in model M2 including all employed learners. However, slightly higher influence was measured in the country variable and the variable measuring reduced possibility to participate in education due to the COVID-19. Table 3 also shows that participants' serious health problems lost their significance and workers in low skilled occupations (ISCO 8–9) had about 2 times lower chance to use online learning platforms than workers in high skilled occupations (ISCO 1–2). The model M2 also reveals that participants' non-reduced chance to be involved in education due to the COVID-19 pandemic increased the chance of using online learning platforms 1.8 times. Overall, model M1 and M2 slightly improved the percentage of correctly classified cases by 0.5 p.p. and correctly classified 78.6% and 79.6% of cases, respectively (see Table 3).

Models M3 and M4 demonstrated a stagnation of predictors' influence on the use of online learning resources in FAE. Only microsocial predictors remained significant; country or occupational status did not make any further impact. More specifically, respondents with serious health problems affecting their everyday life in the past year used online learning resources significantly less than participants without such health problems, with the odds ratio indicating 2 times higher chance to use learning resources regardless of whether they are employed or not. Furthermore,

Table 3. Results of binary logistic regression models for FAE.

	Online learning platforms		Online learning resources	
	All learners	Employed learners	All learners	Employed learners
	M1	M2	M3	M4
Predictor variable	Exp(B)			
Macrosocial variables				
Country (ref. Czech Republic)				
Germany	**2.203**	**3.230**	1.021	0.946
Sweden	**2.625**	**3.727**	0.992	1.120
United Kingdom	**2.242**	**3.010**	1.490	1.443
Occupational status (ref. ISCO 1–2)				
ISCO 3–7	1.083	0.905	0.856	0.807
ISCO 8–9	0.721	**0.464**	0.811	0.682
Company size (ref. less than 50)				
50–250	1.327	1.359	1.258	1.226
More than 250	1.221	1.203	1.241	1.249
Microsocial variables				
Gender (ref. female)	0.886	0.878	**0.655**	0.649
Age (ref. 25–44 years)	0.699	0.757	**0.567**	**0.589**
Health status (ref. with serious health problems)	**1.723**	1.502	**2.085**	**2.029**
Educational opportunities (ref. with reduced opp.)	**1.507**	**1.767**	**1.768**	**2.084**
Education (ref. ISCED 3c or lower)				
ISCED 3ab-4	0.992	0.682	0.716	0.660
ISCED 5–8	1.356	0.897	0.947	0.833
Employment status (ref. 1 FTE)				
0.5 FTE/self-employed	1.029	1.011	1.064	1.058
Other	0.715	–	0.896	–
Constant	1.168	1.379	**3.100**	**3.298**

Bold values are statistically significant.

Table 4. Results of binary logistic regression models for NFE.

	Online learning platforms		Online learning resources	
	All learners	Employed learners	All learners	Employed learners
	M5	M6	M7	M8
Predictor variable	Exp(B)			
Macrosocial variables				
Country (ref. Czech Republic)				
Germany	0.899	0.970	**1.659**	**1.897**
Sweden	**1.647**	**1.823**	**1.961**	**2.094**
United Kingdom	**2.173**	**2.330**	**2.397**	**2.530**
Occupational status (ref. ISCO 1–2)				
ISCO 3–7	1.160	1.052	1.020	1.046
ISCO 8–9	**0.625**	**0.544**	0.724	**0.640**
Company size (ref. less than 50)				
50–250	**0.712**	**0.725**	1.059	1.067
More than 250	0.842	0.903	**0.787**	**0.808**
Microsocial variables				
Gender (ref. female)	0.864	0.806	**0.643**	**0.633**
Age (ref. 25–44 years)	**0.609**	**0.630**	**0.511**	**0.510**
Health status (ref. with serious health problems)	**1.313**	**1.429**	**1.262**	**1.301**
Educational opportunities (ref. with reduced opp.)	**1.347**	**1.352**	**1.711**	**1.688**
Education (ref. ISCED 3c or lower)				
ISCED 3ab-4	1.286	1.343	0.891	0.828
ISCED 5–8	**1.511**	**1.512**	1.002	0.896
Employment status (ref. 1 FTE)				
0.5 FTE/self-employed	0.952	0.979	1.208	1.206
Other	**0.687**	–	1.319	–
Constant	0.912	0.853	**0.598**	**0.613**

Bold values are statistically significant.

reduced education opportunities due to the COVID-19 pandemic, age and gender made significant contribution to the models. Both models correctly classified about 77% of cases, with slight improvement (0.3 p.p. for M3) from Block 0.

Second, we present results regarding NFE. Table 4 contains results of regression models for NFE promising higher improvement of correctly classified cases (from 6.8 to 8.2 p.p.) and presence of more stable predictors. In all models, the country variable made the strongest significant impact (Exp(B) ranging from 1.647 to 2.397) on use of online learning platforms and resources in NFE.

Out of the remaining significant macrosocial variables: respondents in low-skilled occupations (ISCO 8–9) used online resources significantly less than those in high-skilled occupations (ISCO 1–2) (model M5, M6, and M8); and company size made significant impact on use of online learning, suggesting that respondents working for medium-size company of 50–250 employees have about 1.4 times lower likelihood to use online learning platforms than respondents working for company of less than 50 employees (model M5 and M6), and respondents working for large companies with more than 250 employees have about 1.3 times lower chance to use online learning resources (model M7 and M8) than respondents working for a small-size company (less than 50 employees).

While investigating microsocial variables, further results generally show that females used online learning resources significantly more often than males, while older groups of respondents (aged 45+ years) used both online learning platforms and resources less often than younger respondents (aged 25–44 years), with an average odds ratio 0.565 indicating a 1.8 times higher chance of younger adults use these learning platforms and resources. Further, the chance of usage of online learning platforms and resources is significantly higher in those participants who did not experienced reduced educational opportunities due to the pandemic (on average 1.5 times higher) and without serious health problems (on average 1.3 times higher).

The remaining significant microsocial predictors included: educational level (model M5 and M6) that indicates that respondents with a university degree (ISCED 5–8) had 1.7 times higher

chance to use online learning platforms than respondents with secondary or lower education (ISCED 3c or lower), and employment status indicated that all learners (model M5) falling within the employment category 'other' (including retirement, maternity/parental leave, family care, or studies) had 1.5 times lower chance to use online learning platforms.

Finally, we present a summary of the results at two levels of the hierarchy macro and microsocial regression models. Based on Tables 3 and 4 we can state that the role of macrosocial variables can be differentiated into three partial findings: (1) statistically as well as substantially insignificant influence in the case of two models (M3 and M4), showing these predictors are too weak to explain the usage of online learning *resources* among all learners as well as employed learners in FAE; (2) in NFE, however, macrosocial variables play statistically as well as substantially significant role in models M7 and M8 regarding usage of online learning *resources* among all learners as well as employed learners; (3) in four models (M1, M2, M5 and M6), macrosocial factors play an important role when measuring usage of online learning *platforms* among all learners as well as employed learners in both FAE and NFE, where they have a higher explanatory power than variables belonging to the microsocial level based on Cox and Snell R^2, and Nagelkerke R^2 (their values in Table 2 always account for majority of the (pseudo) explained variance of the dependent variable when comparing level 1 (only macrosocial) and level 2 (macrosocial and microsocial variables).

Looking at the microsocial level, its role is relatively balanced compared to the macrosocial level. It is visible that in all models it is useful to add this level as it increases the quality of the models and brings several statistically as well as substantially significant results. Comparing the two forms of adult learning (FAE and NFE), macrosocial variables have more explanatory power in case of usage of online learning resources in NFE (models M7 and M8) compared to FAE (models M3 and M4). Moreover, usage of online learning platforms and resources share similar pattern without differentiation between employed and all learners in FAE and NFE. Employment itself plays the most important role in substantially heightening the chances of usage of online learning platforms in FAE (models M1 and M2).

Discussion

The aim of this article is to compare the usage of online learning platforms and resources in the Czech Republic, Germany, Sweden, and the United Kingdom. We were able to show that there are clear differences among the four countries. Using descriptive statistics, Sweden and the United Kingdom reached the highest rates of usage, while the lowest were consistently found in the Czech Republic. This pattern was also confirmed by logistic regression models, in which 'country' was among the most important macrosocial determinants (except for the usage of online learning resources in FAE – see below). This finding is *consistent with the results of DESI 2020 and its indicator for online learning. But with our data, we are able to show in more detail that the patterns differ in FAE and NFE.*

It is clear that digitalisation unfolds in different patterns in NFE and FAE. *Online learning platforms and resources are used more in FAE than in NFE.* There is an apparent wide gap in FAE between the share of learning delivered online (average 31.4%) and the usage of online learning platforms (average 75.9%). The gap is much smaller in NFE with 47.8% average online delivery and 55.6% average usage of online platforms. This could indicate, that the usage of platforms in NFE overlaps with online delivery. In FAE, on the other hand, learning platforms clearly have a supporting role for education delivered offline as they are used in much more instances than what constitutes online delivery.

The patterns identified above have implications for how we assess the current state of platformization. Not only are there substantial differences between countries (Artopoulos, 2023) but there are also substantial differences within countries in how and how much digital platforms are used in education. From the differences between NFE and FAE, we can generalise two modes of platformization channelled through educational institutions: (1) one that substitutes face-to-face contact in the educational setting, and (2) one that supplements it. While we may intuitively expect the platformization mechanisms of datafication, commodification and selection (Poell et al., 2019;

van Dijck et al., 2018) to unfold when learning is delivered fully online, the literature on platformization of education provides many case studies that demonstrate these mechanisms at work even in instances where there is still physical presence of learners involved (e.g. Kerssens & van Dijck, 2021, 2023; Kumar et al., 2019). The results, therefore, show *platformization well underway in formal adult education, even if majority of it is still taking place through face-to-face interaction*.

Furthermore, platformization driven by users (as indicated by the use of online learning resources) differs in one key aspect: in FAE, this form of platformization does not differentiate among the four countries. This seems to indicate that as opposed to the institutional setting, FAE learners are much more homogeneous across the four countries (at least in this regard). In NFE, on the other hand, usage of online learning resources still differentiates the countries even though the overall percentage of use is much smaller than in FAE (but still substantial). The rates of use of online learning resources in FAE and NFE suggest that platformization is also permeating the learning process outside of the educational setting. This finding is consistent with the literature arguing that digital platforms cross established boundaries (e.g. Kerssens & van Dijck, 2023) and points to the need to investigate platform practices (Duffy et al., 2019) of learners.

Considering RA2, there seems to be some *overlap between factors determining overall participation in AET in general* (Boeren, 2016, 2023; Roosmaa & Saar, 2010, 2012; Rubenson, 2018; Saar & Räis, 2017) *and factors that influence online learning specifically*. For instance, higher age has been consistently shown to lower the probability of participation in AET while in our analysis, it also predicts lower participation in the investigated forms of online learning. This could be due to less well-developed digital literacy (Pihlainen et al., 2023) or lacking technical and social support (Fong et al., 2022). On the other hand, it is very interesting to see that educational level is not statistically significant in determining the usage of online learning platforms or resources (except for one category in NFE). This could point to the role of online learning as a provider of learning opportunities to unexpected segments of the population (Eynon & Helsper, 2011). However, it is important to note that our sample was not representative of the educational structure in Germany and the UK and, therefore, this finding should be received with caution. A peculiar finding is that females in the age cohort 25–44 have a significantly higher probability of using online learning resources than other categories of respondents. In light of recent findings regarding the role of gender in adult education and training (Kočvarová et al., 2022; Vaculíková et al., 2021), we could speculate that the increased usage of online learning resources by females is a coping strategy related to situational barriers to participation stemming from family and care commitments and also less direct financial support from employers compared to males. Therefore, the utilisation of online learning resources could be seen as a compensatory mechanism.

There are also differences between NFE and FAE in terms of the analysed factors. As already discussed above, the usage of online learning resources in FAE is not a significant factor that would differentiate the four countries. In NFE categories related to employment (occupational status and company size) are significant (as opposed to FAE), reflecting the role of employers and occupation types in online learning. This seems to suggest that the occupation structure of the countries (Thelen, 2019; Večerník, 2022) influence the rates of online learning predominantly in NFE and that online learning in FAE is determined by a different set of factors.

Finally, health problems affecting participants' everyday life and reduced educational opportunity due to COVID-19 pandemic consistently decrease the usage of platforms and resources across NFE and FAE despite adults' employment status. Therefore, it seems that the forms of online learning investigated here are not used to compensate for the inability to participate in AET for health-related reasons. If online learning is to be seen as increasing accessibility of AET, it does so only for certain categories of learners (see discussion of gender and education above). This finding is consistent with research on the availability of (and the ability to draw benefits from) other services provided online (Lupač, 2018; van Dijk, 2020). The onset of online learning seems to be *adding a new layer of mechanisms which mediate participation* and could be introducing new forms of inequalities in AET.

Limitations

In relation to the reference period used in measuring individuals' participation in FAE and NFE, a clear limitation of our research involves difficulty for respondents to recall all past learning activities and their online or offline delivery. One of the possible ways to overcome such limitation of self-reporting is, for example, in case of employed respondents, the use of the employee's learning record registered by the employer. Moreover, our sample did not attain a representative distribution of educational attainment in the UK and Germany, where there was a disproportionately high number of adults with tertiary education. This discrepancy may contribute to elevated rates of online platform usage in these countries compared to the general population. Future research should address this discrepancy.

Another weakness of the present study is the limited inclusion of independent variables related to the usage of online learning platforms and resources particularly important within learning activities oriented towards job training. Those variables represent mesosocial factors such as learning providers´ organisation and culture, and job characteristics. Also, microsocial variables including individuals´ personality, living situation or learning habits are completely missing. However, the presented research included primarily the variables that appeared to be relevant in the current literature and were applicable for the vast majority of respondents, as well as specific variables newly tested within our research.

Recommendations for future research

Given the established presence of platforms in AET and their transformative influence widely documented in the literature, further research in these directions is urgently needed. There are several directions for future research that this article provides. First, future research should generate, analyse and compare data on more countries in order to gain a more comprehensive picture of platformization in AET internationally, while retaining the ability to differentiate among specific segments within the educational systems of individual countries (i.e. NFE and FAE). Second, future research should focus on the distinguishing characteristics of platformization that substitutes face-to-face interaction and platformization that supplements it as educational systems seem to be differentiated according to these two modalities. Third, future research should investigate the specifics of learner driven and institutionally driven platformization as this also proved to be a significant categories in the analysis. Fourth, future research should refine our findings on factors of platform usage as they increasingly mediate participation in AET.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Tomáš Karger http://orcid.org/0000-0002-5624-8916
Jan Kalenda http://orcid.org/0000-0002-4871-4753
Jitka Vaculíková http://orcid.org/0000-0002-0711-548X
Ilona Kočvarová http://orcid.org/0000-0002-7070-7998

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics committee approval statement

The study was approved by the Ethics Committee of Tomas Bata University in Zlín on 2 June 2022 (decision no. 2).

References

Agrawal, S., De Smet, A., Lacroix, S., & Reich, A. (2020). To emerge stronger from the COVID-19 crisis, companies should start reskilling their workforces now. *McKinsey & Company*. https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/to-emerge-stronger-from-the-covid-19-crisis-companies-should-start-reskilling-their-workforces-now

Artopoulos, A. (2023). Labyrinths of platformization of education in the Global South (and beyond). In C. Cobo & A. Rivas (Eds.), *The New Digital Education Policy Landscape* (pp. 147–164). Routledge.

Benkler, Y. (2011). *The Penguin and the Leviathan: The Triumph over Self-Interest*. Currency.

Boeren, E. (2016). *Lifelong learning participation in a changing policy context. An interdisciplinary theory*. Palgrave Macmillan.

Boeren, E. (2023). Conceptualizing lifelong learning participation – theoretical perspectives and integrated approaches. In M. Schemann (Ed.), *International Yearbook of Adult Education 2023* (pp. 17–31). wbv Media. https://doi.org/10.3278/I73910W002

Cabus, S., Ilieva-Trichkova, P., & Štefánik, M. (2020). Multi-layered perspective on the barriers to learning participation of disadvantaged adults. *Zeitschrift für Weiterbildungsforschung*, *43*(2), 169–196. https://doi.org/10.1007/s40955-020-00162-3

Cappello, G. (2022). The platformization and commodification of italian schools during the covid-19 crisis: implications for policy and future research. In *Education and Emergency in Italy* (pp. 219–237). Brill. https://doi.org/10.1163/9789004523234_010

Castells, M. (2009). *The rise of the network society*. Wiley-Blackwell.

Cone, L. (2023). The platform classroom: Troubling student configurations in a Danish primary school. *Learning, Media and Technology*, *48*(1), 52–64. https://doi.org/10.1080/17439884.2021.2010093

da Silva Neto, V. J., & Chiarini, T. (2023). The platformization of science: Towards a scientific digital platform taxonomy. *Minerva*, *61*(1), 1–29. https://doi.org/10.1007/s11024-022-09477-6

Desjardins, R. (2014). *Rewards to skill supply, skill demand and skill-mismatch. studies using the adult literacy and lifeskills survey* [Doctoral thesis Lund University School of Economics and Management, LUSEM]. Department of Economics, Lund University.

Desjardins, R., & Ioannidou, A. (2020). The political economy of adult learning systems - some institutional features that promote adult learning participation. *Zeitschrift für Weiterbildungsforschung*, *43*(1), 143–168. https://doi.org/10.1007/s40955-020-00159-y

Desjardins, R., & Kim, J. (2023). Inequality in adult education participation across national contexts: Is growing employer support exacerbating or mitigating inequality in participation? In M. Schemman (Ed.), *International Yearbook of Adult Education 2023* (pp. 75–98). wbv Media. https://doi.org/10.3278/I73910W005

Duffy, B. E., Poell, T., & Nieborg, D. B. (2019). Platform practices in the cultural industries: Creativity, labor, and citizenship. *Social Media + Society*, *5*(4), 5(4. https://doi.org/10.1177/2056305119879672

Dunn, P. T. (2020). Participatory infrastructures: The politics of mobility platforms. *Urban Planning*, *5*(4), 335–346. https://doi.org/10.17645/up.v5i4.3483

European Commission. (2020). *Digital economy and society index (DESI) 2020*. https://digital-strategy.ec.europa.eu/cs/node/924

Eurostat. (2018). *Participation in adult education*. https://ec.europa.eu/eurostat/web/education-and-training/data/database

Eurostat. (2024). Data Browser. https://ec.europa.eu/eurostat/databrowser/bookmark/263978ec-312d-40f4-aca1-b9ef4176e30a?lang=en

Eynon, R., & Helsper, E. (2011). Adults learning online: Digital choice and/or digital exclusion? *New Media & Society*, *13*(4), 534–551. https://doi.org/10.1177/1461444810374789

Eynon, R., & Malmberg, L.-E. (2021). Lifelong learning and the Internet: Who benefits most from learning online? *British Journal of Educational Technology*, *52*(2), 569–583. https://doi.org/10.1111/bjet.13041

Fong, B. Y. F., Yee, H. H. L., Ng, T. K. C., & Law, V. T. S. (2022). The use of technology for online learning among older adults in Hong Kong. *International Review of Education*, *68*(3), 389–407. https://doi.org/10.1007/s11159-022-09957-7

Gegenfurtner, A., & Ebner, C. (2019). Webinars in higher education and professional training: A meta-analysis and systematic review of randomized controlled trials. *Educational Research Review*, *28*(1), 100293. https://doi.org/10.1016/j.edurev.2019.100293

Gegenfurtner, A., Schmidt-Hertha, B., & Lewis, P. (2020). Digital technologies in training and adult education. *International Journal of Training and Development*, *24*(1), 1–4. https://doi.org/10.1111/ijtd.12172

Helberger, N., Pierson, J., & Poell, T. (2018). Governing online platforms: From contested to cooperative responsibility. *The Information Society*, *34*(1), 1–14. https://doi.org/10.1080/01972243.2017.1391913

Herteis, C. H., & Billett, S. (2023). Knowledge and learning at the workplace in times of digital transformation. In K. Evans, J. Markowitsch, W. O. Lee, & M. Zukas (Eds.), *Third International Handbook of Lifelong Learning. Springer International Handbooks of Education* (pp. 163–182). Springer.

Hillman, T., Rensfeldt, A. B., & Ivarsson, J. (2020). Brave new platforms: A possible platform future for highly decentralised schooling. *Learning, Media and Technology*, *45*(1), 7–16. https://doi.org/10.1080/17439884.2020.1683748

Hoijtink, M., & Planqué van Hardeveld, A. (2022). Machine learning and the platformization of the military: A study of google's machine learning platform TensorFlow. *International Political Sociology*, *16*(2), 1–19. https://doi.org/10.1093/ips/olab036

Ideland, M. (2021). Google and the end of the teacher? How a figuration of the teacher is produced through an ed-tech discourse. *Learning, Media and Technology*, *46*(1), 33–46. https://doi.org/10.1080/17439884.2020.1809452

ILO. (2022). *World employment and social outlook: Trends 2022*. International Labour Organization.

International Chamber of Commerce/ESOMAR. (2016). *ICC/ESOMAR international code on market, opinion and social research and data analytics*. ESOMAR. https://www.esomar.org/uploads/pdf/professional-standards/ICCESOMAR_Code_English.pdf

Jenkins, H. (2013). *Spreadable Media: Creating Value and Meaning in a Networked Culture*. NYU Press.

Jones, C. (2015). *Networked Learning. An educational paradigm for the age of digital networks*. Springer.

Jütte, W., & Wildemeersch, D. (2017). Editorial: Digital the new normal - multiple challenges for the education and learning of adults. *European Journal for Research on the Education & Learning of Adults*, *8*(1), 7–20. https://doi.org/10.3384/rela.2000-7426.relae13

Kerssens, N., & van Dijck, J. (2021). The platformization of primary education in the Netherlands. *Learning, Media and Technology*, *46*(3), 250–263. https://doi.org/10.1080/17439884.2021.1876725

Kerssens, N., & van Dijck, J. (2023). Transgressing local, national, global spheres: The blackboxed dynamics of platformization and infrastructuralization of primary education. *Information Communication & Society*, 1–17. https://doi.org/10.1080/1369118X.2023.2257293

Kočvarová, I., Vaculíková, J., & Kalenda, J. (2022). Development and initial validation of the nonparticipation in nonformal education questionnaire. *Journal of Psychoeducational Assessment*, *40*(3), 400–415. https://doi.org/10.1177/07342829211060571

Kumar, P. C., Vitak, J., Chetty, M., & Clegg, T. L. (2019). The platformization of the classroom: Teachers as surveillant consumers. *Surveillance & Society*, *17*(1/2), 145–152. https://doi.org/10.24908/ss.v17i1/2.12926

Lupač, P. (2018). *Beyond the Digital Divide: Contextualizing the Information Society*. Emerald Publishing Limited. https://doi.org/10.1108/9781787565470

Lythreatis, S., Singh, S. K., & El-Kassar, A.-N. (2022). The digital divide: A review and future research agenda. *Technological Forecasting & Social Change*, *175*, 121359. https://doi.org/10.1016/j.techfore.2021.121359

McAfee, A., & Brynjolfsson, E. (2017). *Machine, platform, crowd: Harnessing our digital future*. W.W. Norton & Company.

Nichols, T. P., & Garcia, A. (2022). Platform Studies in Education. *Harvard Educational Review*, *92*(2), 209–230. https://doi.org/10.17763/1943-5045-92.2.209

Pangrazio, L., Stornaiuolo, A., Nichols, T. P., Garcia, A., & Philip, T. M. (2022). Datafication meets platformization: Materializing data processes in teaching and learning. *Harvard Educational Review*, *92*(2), 257–283. https://doi.org/10.17763/1943-5045-92.2.257

Pihlainen, K., Ehlers, A., Rohner, R., Cerna, K., Kärnä, E., Hess, M., Hengl, L., Aavikko, L., Frewer-Graumann, S., Gallistl, V., & Müller, C. (2023). Older adults' reasons to participate in digital skills learning: An interdisciplinary, multiple case study from Austria, Finland, and Germany. *Studies in the Education of Adults*, *55*(1), 101–119. https://doi.org/10.1080/02660830.2022.2133268

Plantin, J.-C., Lagoze, C., Edwards, P. N., & Sandvig, C. (2018). Infrastructure studies meet platform studies in the age of Google and Facebook. *New Media & Society*, *20*(1), 293–310. https://doi.org/10.1177/1461444816661553

Poell, T., Nieborg, D. B., & Duffy, B. E. (2022). Spaces of negotiation: Analyzing platform power in the news industry. *Digital Journalism*, *11*(8), 1391–1409. https://doi.org/10.1080/21670811.2022.2103011

Poell, T., Nieborg, D., & van Dijck, J. (2019). Platformisation. *Internet Policy Review*, *8*(4). https://doi.org/10.14763/2019.4.1425

Roosmaa, E.-L., & Saar, E. (2010). Participating in non-formal learning: Patterns of inequality in EU-15 and the new EU-8 member countries. *Journal of Education & Work*, *23*(3), 179–206. https://doi.org/10.1080/13639080.2010.486396

Roosmaa, E.-L., & Saar, E. (2012). Participation in non-formal learning in EU-15 and EU-8 countries: Demand and supply side factors. *International Journal of Lifelong Education*, *31*(4), 477–501. https://doi.org/10.1080/02601370.2012.689376

Roosmaa, E.-L., & Saar, E. (2016). Adults who do not want to participate in learning: A cross-national European analysis of their barriers. *International Journal of Lifelong Education*, *36*(3), 254–277. https://doi.org/10.1080/02601370.2016.1246485

Rubenson, K. (2018). Conceptualizing participation in adult learning and education. Equity issues. In M. Milana, S. Webb, J. Holford, R. Waller, & P. Jarvis (Eds.), *The Palgrave international handbook on adult and lifelong education and learning* (pp. s. 337–357). Palgrave Macmillan.

Saar, E., & Räis, M. L. (2017). Participation in job-related training in European countries: The impact of skill supply and demand characteristics. *Journal of Education & Work*, *30*(5), 531–551. https://doi.org/10.1080/13639080.2016.1243229

Scheerder, A., van Deursen, A., & van Dijk, J. (2017). Determinants of Internet skills, uses and outcomes. A systematic review of the second- and third-level digital divide. *Telematics and Informatics*, *34*(8), 1607–1624. https://doi.org/10.1016/j.tele.2017.07.007

Shirky, C. (2008). *Here comes everybody: The power of organizing without organizations*. Penguin Books.

Srnicek, N. (2017). *Platform capitalism*. Polity Press.

Thelen, K. A. (2019). Transitions to the knowledge economy in Germany, Sweden, and the Netherlands. *Comparative Politics*, *51*(2), 295–315. https://doi.org/10.5129/001041519X15647434969821

UNESCO. (2011). *International Standard Classification of Education ISCED*. https://uis.unesco.org/sites/default/files/documents/international-standard-classification-of-education-isced-2011-en.pdf

Vaculíková, J., Kalenda, J., & Kočvarová, I. (2021). Hidden gender differences in formal and non-formal adult education. *Studies in Continuing Education*, *43*(1), 33–47. https://doi.org/10.1080/0158037X.2020.1732334

van Dijck, J. (2020). Governing digital societies: Private platforms, public values. *Computer Law & Security Review*, *36*, 105377. https://doi.org/10.1016/j.clsr.2019.105377

van Dijck, J. (2021). Seeing the forest for the trees: Visualizing platformization and its governance. *New Media & Society*, *23*(9), 2801–2819. https://doi.org/10.1177/1461444820940293

van Dijck, J., & Poell, T. (2015a). Higher Education in a networked world: European Responses to U.S. MOOCs. *International Journal of Communication*, *9*, 2674–2692.

van Dijck, J., & Poell, T. (2015b). Social media and the transformation of public space. *Social Media + Society*, *1*(2). https://doi.org/10.1177/2056305115622482

van Dijck, J., & Poell, T. (2018). Social media platforms and education. In J. Burgess, A. E. Marwick, & T. Poell (Eds.), *The SAGE Handbook of social media* (pp. 579–591). SAGE.

van Dijck, J., Poell, T., & de Waal, M. (2018). *The platform society*. Oxford University Press.

van Dijk, J. (2020). *The digital divide*. Polity.

Večerník, J. (2022). *Social Stratification in Central Europe. long-term developments and new issues*. Springer.

Williamson, B., & Komljenovic, J. (2022). Investing in imagined digital futures: The techno-financial 'futuring' of edtech investors in higher education. *Critical Studies in Education*, *64*(3), 234–249. https://doi.org/10.1080/17508487.2022.2081587

Williams, R., Will, C., Weiner, K., & Henwood, F. (2020). Navigating standards, encouraging interconnections: Infrastructuring digital health platforms. *Information Communication & Society*, *23*(8), 1170–1186. https://doi.org/10.1080/1369118X.2019.1702709