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The contribution of digital technology training to the digital competency gap. A case study from Austria

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Abstract

In this paper we ask to what extent additional digital training courses improve young people's abilities to solve everyday digital tasks. We use survey data on digital skills, including an assessment of digital competency tasks, collected among adolescents and young adults (14-35 years) in Austria in 2023. The results show that different types of training correlate in both ways: positively (when it comes to basic training) and negatively (when it comes to specialised training). However, regression models including contextual factors such as gender, education and general attitudes towards technology, show that not all effects persist. The paper concludes that additional digital training can have an effect, but educational measures should also put a focus on strengthening positive attitudes towards digital technologies to promote digital competencies.

Note: The Digital Skills Austria studies 2022 & 2023 were financed by the Austrian regulatory authority RTR (Rundfunk- und Telekomregulierungs-GmbH).

Keywords: *digital competencies; further education; digital training, life-long learning, technology commitment, survey research, Austria*

1. Introduction

The pervasiveness of digital technology and its application in nearly all spheres of public, professional and personal life has led to a renewed focus on the pivotal role of digital competencies (Kraus et al., 2021; Salganik, 2019). This is evidenced by policy initiatives such as those campaigned by the European Union which have identified the need for citizens to develop the skills and competencies to master the digital transition (European Commission, 2024). The rationale behind the EU's goal to foster digital competencies is clear: they are indispensable for the workforce and employability, linked to critical thinking and problem-solving beyond the technical sphere. A gap concerning digital competencies may expand (in-)tangible social inequalities as well as reduce social cohesion. However, it remains unclear how to foster these competencies and what educational measures can effectively enhance them. Consequently, the objective of this study is to identify the type of training that correlates with higher scores on the competencies assessment. The subsequent sections provide an overview of the state of research, present insights on the data and methods, summarise the results and a brief discussion of the findings.

2. Background and Reasoning

The social sciences are currently exploring methods for assessing individuals' abilities to navigate in today's digital societies, focusing on developing concepts such as digital competencies, skills, knowledge, and literacy (see e.g. Helsper et al., 2021; van Laar et al., 2020). Recent meta-studies have revealed that discussions on digital skills frequently depend on self-reports, which cannot directly be linked to actual problem-solving competencies (Livingstone et al., 2023). Moreover, discussions on digital literacy are often confined to smaller-scale qualitative case studies within educational contexts, tied to in-depth reflections of actions. The measurement of competencies is relatively rare and faces limitations. It requires technical access, takes longer to complete than typical survey batteries, encounters standardization challenges, and imposes a higher cognitive burden on participants (see e.g. Livingstone et al., 2023, Gruenangerl & Prandner, 2023) In terms of operationalisation, the literature does not always offer clear distinctions between knowledge, skills, literacy, and competencies (Livingstone et al., 2023). Some consensus exists, that the term “digital skills” is used to indicate the ability to use specific technologies, whereas “competencies” are recognised as the goal-oriented application of skills with a focus on problem-solving (Livingstone et al., 2023, Gruenangerl & Prandner, 2023). Indeed, recent research indicates that European citizens’ digital skills and competencies are severely lacking. Van Kessel et al. (2022) show that only a third of respondents to the EUROBAR survey met the EU DIGCOMP Framework's basic skill level, with notable disparities across countries. For Germany (Initiative D21, 2021) and Austria (Rinner et al., 2022) studies have indicated that competencies are underdeveloped, despite the widespread use of technology. Further research suggests that digital navigation ability is less tied to sociodemographics but rather to attitudes towards technology. Individuals with more open and less fearful attitudes tend to perform better (Gruenangerl & Prandner, 2022, 2023). Despite these findings, a systematic literature review by Livingstone et al. (2023) concludes that only a few studies have examined the impact of educational programmes on adolescents' digital skills, suggesting a link between academic performance and certain digital activities. Moreover, they indicated that specific complex competencies, like programming, might even negatively affect digital performance. This is noteworthy because specialised education is often considered crucial for acquiring the competencies needed for digital societies (van Laar et al., 2020). Using this as a foundation, we aim to explore the level of digital competencies among young adults, the effectiveness of specific educational courses on solving digital and computational issues, and the influence of attitudes towards technology on these competencies through an Austrian case study.

3. Methods and Data

The dataset used for this article is the 2nd wave of the Digital Skills Austria study[1], a CAWI survey conducted in July 2023. It uses the digital skills measures proposed by Helsper et al. (2021). For this paper, we use a subset: young adults (individuals born in 1988 or later) who are likely to have had at least some formal education including digital issues. We follow an expanded definition of young adults from Cook (2016), which focuses on shared experiences relevant to the research topic. Key component of the 2023 survey was a digital competency test, based on thirteen tasks that required respondents to use their digital skills to solve problems. Each task offered six possible solutions and two opt-out options (see Table 2 for more information)[2]. Due to the complexity of the task, only half of the survey respondents were given this test, and of these 351 were in the age range of interest (14-35 years) for this paper. The reliability[3] of the tasks indicates good measurement consistency. In addition, the study used a 12-item scale on technology commitment developed by Neyer et al. (2016), which assesses attitudes towards digital technologies in three dimensions[4]: technology acceptance (TC1, enthusiasm for technical innovations), technology competence (TC2, feeling overwhelmed or anxious about digital technologies), and technology control convictions (TC3, confidence in the ability to manage and solve technology related problems). Regarding training courses on digital technologies respondents were provided with a list of 7 types of courses, linked to typical use scenarios and to specific aspects of digital technology use (see Table 1 and Figure 1 for more details). Participants could indicate that they had taken a course with or without certification, had tried to take one but cancelled it or had never taken one.

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[1] The full sample includes 2087 people aged 14+ (matching Austrian resident online population, according to age, gender and education), 351 people from this sample correspond to the 14-35 age group, used as a sample in this paper. The Digital Skills Austria studies 2022 & 2023 were finance by the Austrian regulatory authority RTR (Rundfunk- und Telekomregulierungs-GmbH).

[2] This approach provided multiple paths to success: respondents could rely on pre-existing knowledge, use their research skills, or even use trial and error. All of these strategies were considered valid. The item design and selection process was iterative: (1) from the literature (especially Helsper et al., 2021) to identify essential areas, (2) task development within the research team and (3) quality improvement through pretests. Pretests included cognitive probing (heterogeneous test-group of 10), content-based/functional pre-testing (~ 50 BA students).

[3] KR-20 within age group 0.838, within total population 0.828

[4] Attitudes were measured on a five-point scale, ranging from "does not apply at all" to "completely applies". The expected structure of these scales was confirmed through principal component analysis (PCA), as detailed in Table 1 (for item specifics and wording, see Neyer et al., 2016). Note for the sake of transparency: factor extraction was performed on the entire sample (14+).

Table 1: Overview Analysis Variables (Digital Skills Austria 2023, own calculations)

Dimension	Variable/Question	Scale	Mean (Med.) % coded 1
Digital Competencies			
DC	sum-variable of 13 competency tasks (n=351)	0 (no task completed) to 13 (all tasks completed)	4,8 (5)
Technology commitment (factors calculated based on the full sample)			
TC1	technology acceptance (n=1966)	PCA, total variance explained 72 %, KMO 0,824, Cronbach's Alpha 0,871	
TC2	technology competence (n=1970)	PCA, total variance explained 73 %, KMO 0,882, Cronbach's Alpha 0,843	
TC3	techn. contr. convict. (n=1909)	PCA, total variance explained 61 %, KMO 0,789, Cronbach's Alpha 0,783	
Digital training courses			
INTRO	introduction to the basic use of IT or ICT (e.g. ICDL) (n=330)	Yes, with or without certificate (1) / No, aborted or never took a course (0)	43 %
BASIC	basic application software (e.g. word processing) (n=329)		43 %
SPECIAL	specific application software (e.g. graphics, finances, statistics, …) (n=330)		26 %
SOCNET	use of social networks (e.g. Instagram, Facebook, X...) (n=337)		26 %
COLLAB	use of collab. software (e.g. cloud services, workspaces...) (n=331)		22 %
INFRA	specific IT or ICT infrastructure (e.g. networks, SharePoint...) (n=333)		24 %
CODING	programming and coding (e.g. C#, Python...) (n=331)		25 %
Sociodemographic variables (Control)			
Age	Age in years (n=351)	14 to 36	25,7 (26)
Gender	Male or female? (n=351)	female (1) / male (0)	53 %
Education	Less than lower secondary education (n=175) Secondary education (n=106) Tertiary education (n=60)		51 % 31 % 18 %

The next section presents descriptive and linear regression-based analysis. For control purposes the regression models include gender and education.

4. Results

The results of the competency test indicate that on average, the population aged 14 to 35 was able to correctly solve 5 out of 13 tasks provided. However, the results also demonstrate a considerable range from zero to 12 correct answers, with 11 % unable to solve a single task and a further 31 % achieving only 1 to 3 correct solutions. Additionally, no one was able to correctly answer all 13 tasks. Only 2 % of respondents provided 12 correct answers, while 13 % solved 10 or more tasks correctly.

Table 2: Results: competency test, pop.: 14-35 years (Digital Skills Austria 2023, own calculations)

Results of the competency test, population 14-35 years (n=351)	+	-	d.k.
Interaction with AI	61 %	24 %	15 %
Basic knowledge of programme commands	60 %	21 %	19 %
Identification and use of a QR-code	50 %	38 %	12 %
Linking technical devices	50 %	23 %	27 %
Understanding of basic structure of AI	46 %	33 %	21 %
Understanding of secure internet protocols	39 %	41 %	20 %
Understanding of simple programming codes	35 %	24 %	41 %
Understanding of email communication	33 %	48 %	19 %
Basic knowledge of spreadsheet formula	31 %	42 %	27 %
Use of public administration tools, online queries	31 %	48 %	21 %
Information search in social networks	22 %	52 %	26 %
Pinging an IP-adress	14 %	49 %	37 %
Understanding of user-specific advertising	13 %	72 %	15 %

+ = correct solution, - = incorrect solution, d.k. = don't know; sorted by share of correct answers

Upon examination of the specific tasks, it becomes evident that young people exhibited a high degree of familiarity with the interaction with AI, possessed a basic understanding of programme commands and demonstrated the ability to follow a QR-Code or identify appropriate technical standards for linking technical devices. Among the respondents, between 50 and 61 % were able to successfully complete these tasks. Conversely, tasks pertaining to user-specific advertising, the identification of IP-addresses and the execution of an information search on a social network proved more challenging for the young population. The results are largely consistent with previous studies indicating a relatively basic digital competence level among Austrians (Rinner et al., 2022). However, the high number of incorrect responses is striking, especially when compared to admitting a lack of knowledge. This is particularly evident in the context of user-specific advertising, social media usage, and the utilisation of digital public administration tools (see also Table 2)

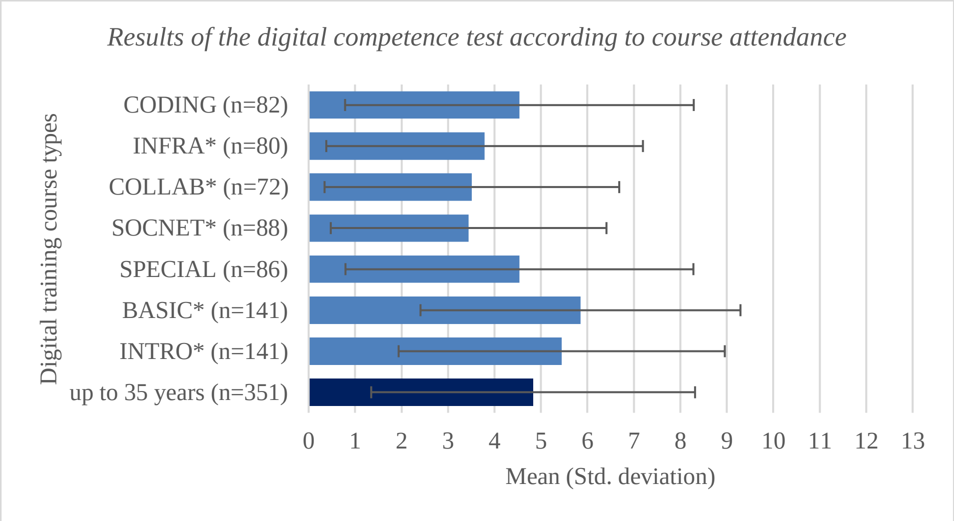

Figure 1: Mean results of the digital competency test with specific course attendance (own calculations, significant t-test results are indicated with *)

Interestingly, when examining various forms of digital technology training, only some of them correlate[5] with better performance. Overall, the spread of competencies shown is quite broad and illustrates that the young Austrian cohort is highly heterogeneous when it comes to their digital competencies. This aligns with the findings of a meta-study by Livingstone et al. (2023), which revealed that individuals who undertook courses on more advanced topics (e.g. coding infrastructure) exhibited poorer overall results. The same is true for those who took courses on social media, collaborative software and specialised software for specific tasks (e.g. statistics, finances, content editing).

The linear regression model modifies these results. It still confirms that basic courses have a positive impact, but only social media-related courses have a negative impact. Other types of courses do not show statistically significant effects. The most important effect comes from including technology commitment. Once introduced to the model, the explained variance increases from 26% to 42% (R^2), emphasising the importance of attitudes towards technology, when discussing competencies. Those who feel overwhelmed by technology (TC2) are more likely to score worse, while those who feel in control of technology (TC3) have better results. Some residual effects concerning education and gender remain. Those with higher education score better, and a small gender bias (men performing better than women) is also present.

[5] All significant t-test results are indicated in Chart 1 with * meaning $p < 0.05$.

Table 3: Linear regression models on digital competence (own calculations)

independent variables		dependent variables			
		digi. comp. (1)		digi. comp. (2)	
dimension	indicator	std. Beta	sig. (p)	std. Beta	sig. (p)
sociodemographic variables	gender (ref.:male)	**-0,199**	**<,001**	**-0,133**	**0,010**
	secondary education (ref.: less)	**0,137**	**0,021**	0,093	0,076
	tertiary education (ref.: less)	**0,292**	**<,001**	**0,211**	**<,001**
training courses on digital technology	INTRO	0,083	0,191	0,058	0,300
	BASIC	**0,283**	**<,001**	**0,197**	**0,001**
	SPECIAL	-0,018	0,783	-0,002	0,967
	SOCNET	**-0,257**	**<,001**	**-0,188**	**<,001**
	COLLAB	-0,124	0,077	-0,094	0,132
	INFRA	-0,073	0,330	-0,072	0,290
	CODING	-0,055	0,421	-0,059	0,339
technology commitment	TC1 technology acceptance (+)			0,043	0,462
	TC2 technology competence (-)			**-0,242**	**<,001**
	TC3 technology convictions (+)			**0,291**	**<,001**
model summary	adjusted R^2		0,265		0,421
	Sig. (p)		<,001		<,001
	n =		250		250

Digital Skills Austria 2023 dataset, population 14-35 years, own calculations, no weights applied. Method: linear regression models on the results of the digital competence test (2) with or (1) without inclusion of the motivational factors. Significant effects ($p < 0,05$) are marked bold.

5. Conclusion

We started this paper with the question if digital training courses offer a chance to increase the performance of individuals in the digital space, thus strengthening digital societies overall. This is of paramount importance, as previous studies have yielded concerning results regarding digital competencies (e.g. van Kessel et al., 2022). Our study of young Austrians indeed revealed a rather low level of digital competencies. The range of results within the population is huge (from 0 to 12 solutions, median 5) and a connection with specific types of training is plausible. Testing indicates that courses on digital technology may not necessarily lead to higher competencies. Multivariate analysis reveals that courses on basic application software may have a positive effect, while social network training may have a negative impact. However, the most substantial effects were tied to the participants' conviction of their ability to handle digital technology related problems and not showing negative attitudes (e.g. anxiety) towards digital technology. Thus, we conclude that education is a necessary tool (especially since tertiary education has an overall positive effect), but definitely needs to focus more on attitude issues (i.e. fostering control convictions and reducing fear and overload due to digital technologies) in addition to actual technical competencies. This message needs to be communicated both in the classroom, and on a broader societal level. Trainings alone will not be able to solve the digital competencies gap as long as negative attitudes remain.

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