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RESEARCH ARTICLE

Digital technology and language learning: insights from teachers of adult migrant learners

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Abstract

Increasing global digitalization is changing the everyday language skills required to participate in society, to carry out professional activities, and to take advantage of educational opportunities. As a result, new linguistic and digital competences are required for migrants. At the same time, digitalization offers new potential for learner-oriented language learning. In this article, we compare the results of two studies on teachers of adult multilingual migrant learners. These teachers instruct learners at different levels of literacy and with varied prior formal learning experiences. Both studies are situated in the German education system. The results illustrate how teachers and learners can work together using digital technologies to promote language learning. We explore the opportunities for effective, multilingual, and motivating language learning, as well as the challenges faced by learners and teachers, pointing to the need for further training in digital technology for both groups.

Keywords: language learning; digital literacy; teacher perspectives; adult learners; migrant learners; multilingualism

1. Introduction

In recent years, there has been a significant yearly increase in the numbers of adult migrants and refugees worldwide, with an estimated 117.3 million since 2011 (UNHCR, 2024). Many of these adult migrants and refugees face myriad challenges in their host country. In addition to needing to learn the language of the country, migrants must obtain employment, find housing, take care of family members, and deal with discrimination, to name a few (Kloubert & Hoggan, 2021; Peyton & Young-Scholten, 2020; Shapiro, Farrelly & Curry, 2018). For some, the highly digitalized societies of their host countries pose a further challenge (Dufva & Dufva, 2019), leading to "information disjuncture" when these migrants encounter unfamiliar and formidable digital information landscapes (Kaufmann, 2018).

Global digital transformation is occurring in every aspect of life, a transformation not limited to technological developments but one having far-reaching social and societal consequences. This digital transformation encompasses a combination of digital innovations that, by bringing

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together "novel actors [. . .], structures, practices, values, and beliefs, change, threaten, replace or complement existing rules" (Hinings, Gegenhuber & Greenwood, 2018: 53). Increasing use of digital technology, for instance, has been changing communication channels by initiating and expanding global networking and exchange opportunities, and affording greater worldwide accessibility to information. To successfully exploit the potential of this digitally changing world, digital literacy skills are required. These skills need to be developed to avoid a *digital divide* in society – that is, the gap between those who have satisfactory access to digital technology and digital media-related educational opportunities and those who do not. In addition to having access, everyone should be able to use the technology to take advantage of its opportunities and benefits. This digital divide is a growing concern for educators. Those who do not have adequate access are limited in their educational potential and economic and social opportunities, leading to social inequalities (Imran, 2023; Lythreatis, Singh & El-Kassar, 2022). While this digital transformation holds significant promise in education and for language learning in particular, digital technology has neither sufficiently been equally adopted by schools or school systems, nor seamlessly been incorporated into pedagogy or leveraged to its potential by either teachers or learners.

In educational debates, the focus has been mainly on primary and secondary schools; however, our focus here is on adult education. Specifically, we explore the challenges and potentials of digital language learning for adult migrant learners in Germany at different literacy levels. We describe the connection between language skills and digital literacy, the importance of digital literacy in German educational contexts, and the potentials and challenges of digitality in language learning. Next, we present the methodology and results of two studies on teachers' perspectives on digitally supported language learning for adult migrants. We conclude with a discussion of issues and potentials.

2. Digital technology and language learning

2.1 Digital literacy and language

Digital literacy can be defined as "the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital technologies" (Law, Woo, de la Torre & Wong, 2018: 6). As claimed by Furber (2012) and Spires, Paul and Kerkhoff (2018), in an educational context, digital literacy has been defined as encompassing the ability to use word processing software; to create and edit content and images, audio, video, and multimedia using web tools; to find and assess information and sources on the internet using a web browser and search engines; and to communicate and interact within digital environments. Since most digital practices are mediated by language, technology inevitably affects language use (Chun, Kern & Smith, 2016; Jones & Hafner, 2012). Digital technology user interfaces are generally coded as text; thus, digital literacy requires language-based skills that are being reshaped in the digital culture (Frederking & Krommer, 2019; Stalder, 2016). The role of language in digital literacy is evident, whether in the context of basic, primarily functional-technical skills, such as typing on the keyboard or opening an email, to tasks demanding more complex language, such as engaging in online research or evaluating the reliability of sources on the internet. These latter skills are termed *critical literacy skills* – that is, the ability to examine and evaluate the quality and reliability of online digital sources and visual content as well as the capacity for self-reflection and evaluation of one's own digital practices and those of others (Bacalja, Beavis & O'Brien, 2022). For teachers, as well as learners, this entails accepting and integrating digital technology as meaningful support for (language) learning (Gutenberg, Maahs & Lawida, 2024).

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2.2 Digital literacy and education

To date, the potential of digital technology in education has not been fully realized. Changes in educational systems progress more slowly than social changes in the use of digital technology, despite the major shift to online learning worldwide during the COVID-19 pandemic (Timotheou *et al*., 2023). Aside from issues of access to the internet and technology, integration is a complex process. Many schools do not have the flexibility, the infrastructure, or mindset to incorporate or transfer creative technology practices from one or two classrooms to larger settings across schools and diverse educational settings (Consortium for School Networking, 2019). Prior to the pandemic, there had been numerous calls to foster greater digital literacy skills in teacher preparation programs, since many teachers were not exploiting the pedagogical potential of digital tools (Starkey, 2020; Tondeur, Aesaert, Prestridge & Consuegra, 2018). During the pandemic, it became apparent that access to technology without digital literacy was not enough and that all stakeholders in education needed stronger digital literacy skills and the ability to integrate digital technology and learning (Gourlay, Littlejohn, Oliver & Potter, 2021; Malessa, 2023; Wohlfart & Wagner, 2023).

Because of the (relative) slowness of schools to embrace digital technology fully, the teaching community risks primarily teaching skills with little relevance and paying too little attention to teaching digital literacy skills important for the 21st century (Gutenberg *et al*., 2024; Maahs & Gutenberg, 2023). This is particularly evident in the German education system. The International Computer and Literacy (ICILS) study examined the use of digital technology in secondary schools internationally in which Germany ranked at the bottom (Drossel, Eickelmann, Schaumburg & Labusch, 2019). The federal state of North Rhine-Westphalia, the state in which our studies took place, performed especially poorly. Only 23.3% of teachers in North Rhine-Westphalia used digital technology daily, with 40% doing so less than once a week. Furthermore, the ICILS study found that, overall, teachers in Germany primarily used digital technology to present information in teacher-fronted classroom teaching. Only 14.8% of them use digital technology frequently or always to promote individualized learning. These ICILS results are in line with an earlier survey study on technology use in German schools that found that after calculators and video projectors, the overhead projector was still the device most frequently used in German classrooms (Schmid, Goertz & Behrens, 2017). When subsequently queried as to how they used digital technology to support the individual needs of their learners, only 25% of the teachers stated that they used such technology to incorporate students' home languages.

The need for digitalization in education to keep pace with societal developments and to leverage the potential of digital technology for pedagogical purposes is clear (Petko, Döbeli Honegger & Prasse, 2018). However, in Germany there is often a gap between implementation and curricular requirements. In North Rhine-Westphalia, this gap is acute (Kultusministerkonferenz [KMK], 2016, 2021). Based on the national educational goals recommended by the Conference of Ministers of Education, the North Rhine-Westphalian Ministry of Education[1] has produced objectives for the digital skills that students should acquire. The guidelines also describe the digital skills that all future teachers in teacher preparation programs should acquire (Medienberatung NRW, 2020). Careful reading of the objectives reveals that the digital skills frequently described are *language skills* related to digital technologies.

For adult integration courses, required for adult migrants and refugees to facilitate their integration into German society, the BAMF (*Bundesamt für Migration und Flüchtlinge* – Federal Office for Migration and Refugees) (2023) has published curriculum guidelines promoting the use of digital technology to support integration. In contrast to the German national and state

[1]In Germany, education is primarily the responsibility of the individual states, or *Bundesländer*. While the Federal Ministry of Education and Research oversees national education strategies, each state has its own ministry of education. In this context, the Ministry of Education of the state of North Rhine-Westphalia independently develops guidelines that are aligned with the national strategies and that detail the media skills expected of students and all future teachers in the region.

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guidelines for primary and secondary school students, these guidelines focus on teaching adult migrant learners the softer skills, such as awareness of the potential of digital technology for language acquisition or the role of digital social networks in Germany. For language learning objectives, the BAMF guidelines present technology competency goals at levels A1 to B1 of the Common European Framework of Reference for Languages (CEFR). The objectives range from very basic functional-technical levels skills, such as using a mobile phone address book, to personal-reflective language skills, such as exchanging media experiences with friends and family members (Frederking, 2022; Kaufmann, 2016). These CEFR objectives demand much lower language proficiency than those of the Conference of Ministers of Education and those of the North Rhine-Westphalia Ministry of Education, which do not take German language proficiency into consideration.

2.3 Challenges and potential of digital tools for language learning

In using digital technology in the context of language learning, a distinction must be made between the new challenges of digitalization and the potential of using digital technology as linguistic support, particularly when considering learners' previous learning experiences (Huesmann & Woerfel, 2022; Malessa, 2023). LESLLA (Literacy Education and Second Language Learning for Adults) learners, for example, are adult migrant learners who are developing emergent reading and writing skills, often for the very first time, in a language that is new to them. Digital technology is typically text-based, requiring both digital literacy and print literacy (Frederking, 2022; Stalder, 2016). Even basic technical skills in the context of digital literacy are challenging for most LESLLA learners since they are outside their prior life experiences and generally require some literacy in the Latin alphabet to log into a computer using a personal password or to open and navigate web pages (Norlund Shaswar, 2022). Moreover, adult learners tend to be less digitally literate and more hesitant than younger learners to engage in digitally assisted learning (Puebla, Fievet, Tsopanidi & Clahsen, 2022) and may have limited access to computers or notebooks. LESLLA learners, given their emergent print literacy and digital literacy skills, may especially feel intimidated and reluctant to learn how to use the hardware.

Nevertheless, digital technology for language learning offers the potential for helping adult migrant learners in their everyday lives by promoting equity and access (Adelore & Ojedeji, 2022; Borkert, Fisher & Yafi, 2018). Mobile-assisted language learning has increasingly developed for learning with smartphones (Kukulska-Hulme, 2019), as well as tablets, which are easy to transport and handle and do not generate the same reluctance to use (Norlund Shaswar, 2022). Many LESLLA learners have smartphones and are comfortable using them for oral communication via video and recording features (Bradley & Al-Sabbagh, 2022; Tammelin-Laine, Vaarala, Savolainen & Bogdanoff, 2020). Smartphones can be a valuable scaffold for all learners, such as using translation aids to enable interaction and learning (Eilola & Lilja, 2021). Digital technology overall offers significant potential for better integrating learners' oral multilingual skills by allowing texts to be spoken and transcribed orally and written texts to be read aloud. Multimedia also has the advantage of making content available through various formats and learning modes (e.g. visual, auditory, interactive), and informational sources and learning content (e.g. online newspapers, explanatory videos) can be accessed in different languages (Lawida & Maahs, 2022; Maahs, Lawida, Gutenberg & Drews, 2023). The adaptability of digital texts, which can be tailored to suit the needs of readers, enhances accessibility for learners by allowing customizable font sizes, audio options, and translation tools.

In contrast to the significant challenges LESLLA learners face with respect to digitization, other adult migrant learners with good literacy and more prior education are likely to be familiar with technology and to have used a variety of devices, programs, and digital tools. Although the challenges of digitization may be different for both populations, questions remain as to how – and

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to what extent – digital technology is used by both groups of learners and their teachers to support learning.

We now turn to consider the perspectives of teachers of migrant adult learners in Germany, and how digital literacy and digital technology are (or are not) leveraged in learning. We begin by presenting the digital literacy and learning experiences of two disparate groups of adult migrant learners in two German learning contexts: (1) government-required language courses for refugees and migrants, and (2) a so-called *second-chance education* program that offers an alternative pathway for adults to achieve educational qualifications mirroring the curriculum of regular secondary education. We outline challenges and potentials of digital technology for (language) learning for both groups of learners in these different learning contexts and conclude by considering the implications of social inequities in education.

3. The studies

Our research is based on a synthesis of data from two qualitative studies with adult education teachers who were interviewed as experts in their own teaching (Maahs, DeCapua & Triulzi, 2023). Both studies explored the broader themes of opportunities for and challenges in language learning, focusing on multilingualism. In this paper, the findings from the perspective of new research questions are juxtaposed and discussed anew. In these two studies, it became apparent that the increasing digitalization of German society and education, while offering new potential and opportunities, has also created new language learning challenges that vary greatly, depending on the learning context, the attitudes, competencies, and digital technology available to teachers and learners.

Our research questions for the analytical merging of the two studies were as follows:

1. What do teachers view as the challenges and potentials of digital language learning for adult migrants and refugees?
2. From the perspective of teachers, how do the challenges and potentials of digital language learning differ among learners with varying levels of literacy?

3.1 Methods

3.1.1 Sample and target group: Study 1

This first study – conducted in the summer term of 2021 – involved semi-structured interviews with teachers of German as a second language (Maahs *et al.*, 2023). The participants were selected through purposive sampling to ensure the inclusion of knowledgeable and experienced teachers (Creswell & Plano Clark, 2017). There were 10 female teachers and one male teacher, making a total of 11 study participants. These teachers taught recent adult migrants in four federal states (North Rhine-Westphalia, Bavaria, Lower Saxony, and Hesse) and worked in different settings, ranging from government-subsidized integration courses to classes in refugee centers.

Government-subsidized integration courses are highly institutionalized, required to follow a set curriculum with government-approved teaching materials, and are based on a traditional classroom setting. Other courses, such as those in refugee centers, are less formalized, with non-mandatory attendance, high attendance rate fluctuations, and less structured curricula. These settings generally have insufficient digital learning technology and infrastructure.

The teachers reported that their adult migrant learners had little to no literacy in any language and minimal or no access to education prior to coming to Germany. They were placed into an A1-level integration course based solely on their language proficiency. As an adult, learning to read and write for the first time or developing literacy skills beyond the basics generally requires significant time (Kurvers, 2015; Tarone, Bigelow & Hansen, 2009). For example, LESLLA learners

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struggle with metalinguistic skills that support language learning, such as analyzing the parts of a sentence or explicitly distinguishing word forms and functions (Gonzalves, 2021). Writing is not easy for them, ranging from the mechanics of using a writing instrument or typing/tapping on a keyboard to engaging in the process of composing grammatically appropriate sentences and short texts.

3.1.2 Sample and target group: Study 2

The second study, conducted July–October 2023, involved eight teachers (six female, two male), who had been purposively sampled from a second-chance education program, the *Weiterbildungskolleg* (WbK) in Bonn, North Rhine-Westphalia. The WbK offers adults another opportunity to obtain formal secondary school qualifications, including *Abitur*, the German school leaving certificate required for entry to higher education. The WbK is a hybrid education system, incorporating elements of both secondary schooling and adult education.

Most of the WbK learners were not recent migrants to Germany and, according to their teachers, had arrived with literacy skills and prior education, although the learners' schooling may have been interrupted due to war and/or migration. Many of the WbK learners had developed their literacy skills in a non-Latin alphabet writing system, such as Arabic. Although these learners had to learn German and develop content and/or work knowledge while developing literacy skills in the Latin alphabet, they were able to transfer many of their literacy skills, as well as study habits, to the new learning context.

Some WbK learners had diplomas from their home countries, which, however, are not recognized or accepted in Germany or not considered sufficient preparation for continuing their studies or pursuing better work opportunities. These learners were consistently confronted with the dilemma of having their prior qualifications, be they educational, professional, or vocational, not accepted in Germany or even by a particular German state (Münk & Scheiermann, 2020). Consequently, the WbK learners had previously been placed in lower schooling levels than they had already completed, required to restart training or professional programs, or eligible only for jobs below their prior qualifications (Kloubert & Hoggan, 2021). The WbK therefore was their "second chance."

3.2 Data collection and analysis

We collected the data in both studies through semi-structured interviews recorded over Zoom and subsequently transcribed using f4 software. To ensure confidentiality, pseudonyms were assigned. We analyzed the data inductively, using structured qualitative content analysis, a systematic process for defining and identifying themes (Kuckartz & Rädiker, 2022). Such an analysis entails methodically organizing data by initially identifying major themes and subsequently identifying various levels of subcategories through an ongoing reflective process of reading and re-reading the data. Once we had established guidelines and key examples for major themes and subcategories, we independently re-examined and reflected on the data. We discussed any instances of coding uncertainty until we reached a consensus.

Coding was carried out using Excel for the first study and MAXQDA, a software tool designed for qualitative data analysis with multiple coders, for the second study. Later, we engaged in a second inductive qualitative analysis of the transcripts from both studies, this time focusing specifically on themes and subcategories related to digital language learning and using MAXQDA exclusively. Subsequently, we compared the data from both studies.

In Study 1 (Maahs *et al.*, 2023), of the 12 main themes identified, one dealt exclusively with digital aspects of teaching and learning: "Theme 7. Use of digital technology." Under Theme 7, we identified six subcategories (see bolded items in Table 1). The other 11 themes are shown in Table 1 without the subcategories, since the data are not relevant to the present combing of the two

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Table 1. Study 1 themes and relevant subcategories

1. Description of the learner group
2. Challenges posed by learning practices
3. Language diagnostics
4. Heterogeneity of the target group
5. Dealing with heterogeneity
6. Dealing with multilingualism
7. Use of digital technology
7.1 Didactic use of social media
7.2 Digital tools
7.3 Technical equipment of the teacher and the classroom
7.4 Course participants' digital devices
7.5 Online teaching
7.6 Challenges posed by low literacy
7.7 Connecting with participants through online tools
7.8 No use of digital media
7.9 Internet as a danger
8. Exam preparation
9. Challenges due to family situations
10. Support from the organization
11. Structural criticism
12. Ethnocentrism

Table 2. Study 2 themes and relevant subcategories

1. Challenges for teachers
1.5 Digital competence of teachers as a challenge
2. Strengths of learners at the WbK
3. Challenges faced by learners at the WbK
4. Dealing with heterogeneity
4.2.3 Use of digital media in the classroom
5. Description of the heterogeneity of the target group
6. Teacher background

studies. A complete overview of the category systems of both studies can be found in the Appendix (see supplementary material).

In Study 2, digital technology use in teaching and learning was addressed in two subcategories under two major themes, highlighted in bold in Table 2. As only these aspects are important for the present analysis, not all subcategories are included in Table 2 but can be found in the Appendix (see supplementary material).

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3.3 Findings

3.3.1 Study 1

Online teaching and course participants' access to digital devices

The first study revealed a mixed landscape with respect to teachers' use of digital technology in learning. Ten of the 11 teachers stated that they had not used digital technology prior to the onset of the COVID-19 pandemic. This underscores the abrupt transition they faced when forced to shift to online teaching via asynchronous online platforms or videoconferencing. Unfortunately, this shift was largely unsuccessful due to the lack of digital literacy among their LESLLA learners, as well as their lack of digital devices. These learners were unfamiliar with even functional-technical skills, such as logging on or navigating web pages. This was heightened by both their low proficiency in German and their emergent literacy. Moreover, economic inequalities quickly became evident in the learners' lack of access to laptops or tablets, with some learners never having owned or used one. A number of the LESLLA learners had only some access to smartphones, and these had limited data plans.

Challenges in dealing with digital media due to low literacy

During the pandemic, the German government provided subsidies for home computers for learners in integration courses. The challenges of setting up the software, as well as learning the basics of using the hardware, were significant for the LESLLA learners, even when a learner was able to find someone bilingual to help. As one teacher pointed out, that person might be orally bilingual but was not necessarily able to read German.

The difficulties in setting up digital technology extended to mobile applications, as many learners struggled to install them, constantly relying on teacher support. This created another challenge, since the learners' mobile phones were set up in a language unfamiliar to the teachers:

> And I said, "It would be nice if you could install it." Then they all looked at me in shock and had no idea. Then they brought me their mobile phone, all in Arabic. And I can't read it either (laughs) and I tried to install it."[2] (Sabine)

Didactic use of digital tools and social media

Although the digital challenges were formidable, the study also revealed potential opportunities for digital technology in language learning. In particular, the use of WhatsApp proved to be a positive experience for lesson explanation and teacher–student communication. WhatsApp proved to be more accessible than some online learning portals provided by German educational institutions during the pandemic. The recording feature was used creatively by teachers, demonstrating a responsive approach to supporting language learning for these LESLLA learners. The application also facilitated collaborative learning environments. For example, learners who had somewhat more digital literacy shared visual and auditory resources, such as links to YouTube videos, in the class group chat. Because the LESLLA learners, as noted by their teachers, were unaccustomed to independent learning, such collaborative environments provided their learners essential support:

> . . . and through [WhatsApp] we could actually always communicate. So organizational things that were impossible for me to do in this actual classroom tool because the people there were not . . . , uhm, unless you said exactly "Now do this, now press this," then nothing happened. Even writing some messages or something like that. Or linking things, that was not possible.[3] (Brigitte)

[2]Original: Und habe gesagt: „Es wäre nett, wenn ihr die installieren könntet." Dann guckten mich alle ganz geschockt an und wussten überhaupt nichts. Dann brachten sie mir ihr Handy, alles in Arabisch. Und ich kann das auch nicht lesen (lacht) und habe das dann versucht, zu installieren. Translation by the authors.

[3]Original: . . . und dadurch konnten wir halt eigentlich immer auch kommunizieren. So organisatorische Sachen, die in diesem eigentlichen Unterrichtstool für mich unmöglich waren, weil die Leute da irgendwie nicht, ähm also wenn man nicht genau gesagt hätte „jetzt macht dieses, jetzt drück da", dann war da nichts. Also auch irgendwelche Nachrichten schreiben oder so. Oder Sachen verlinken, das war nicht möglich. Translation by the authors.

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3.3.2 Study 2

Technical conditions for using digital media in the classroom

The second study provided valuable insights into the challenges faced by the WbK teachers. This study shed light on the current landscape of digital technology in this very different educational context serving a considerably different population of adult migrant learners.

The WbK teachers generally perceived their institution as being well prepared for digital teaching. One notable limitation was the lack of Wi-Fi in the school, which posed a challenge to the effective integration of digital technology into the teaching and learning environment. Connectivity issues compounded the challenges for smartphone-dependent learners, and downloading digital resources required significant data consumption, a financial concern for learners with limited data plans.

Digital competence of teachers

Despite teachers' positive perceptions of digital learning at the WbK, there was a predominant sense that digital technology was supplemental rather than integral to teaching and learning. Teachers expressed a sense of inadequacy in their own digital education training, adopting a "learning-by-doing" strategy. They primarily attributed this to a lack of formal preparation, which prevented them from setting learning objectives to promote digital literacy and incorporate digital technology. The teachers did report recent increased efforts to gradually integrate digital technology into their pedagogy. This increase was particularly noticeable after they had participated in school-provided training, suggesting a positive shift towards the acceptance and adoption of technology. In some cases, it was the WbK learners themselves who introduced teachers to new applications, demonstrating a proactive engagement with technology and providing an avenue for collaborative exploration:

> Perhaps one last factor, and this is a long shot, is the many apps that people use //mhm// on their mobile phones, which they then also show me. Tell me, Frau Schmidt, I use this, is that OK or is that how I translate when I sometimes ask, how do you actually do that? And then I realize that they sometimes teach me something. I think that's motivating for them too. But I can see that there are a lot of tools that help them.[4] (Melanie)

Nevertheless, the use of technology was mainly supplemental, without clear educational goals and objectives.

Didactical use of digital media in the classroom

The study identified various digital technologies that teachers were aware of and partially used, especially H5P. This is an open-source content creation and collaboration framework for creating interactive and multimedia content on the web that allows users to easily create, share, and reuse interactive content, such as quizzes, games, and interactive videos. The main challenge here was that most learners had only smartphones; thus, when digital technology was not used collectively in the classroom, learners had to navigate and engage on their small smartphone screens.

Teachers also described using YouTube videos for group activities such as analyzing original speeches. One teacher reported that courses for independent learning of German had been set up on Moodle. Another teacher reported a positive use of multilingual applications in subjects such as maths, contributing to a more inclusive learning environment:

[4]Original: Ein letztes vielleicht noch sind Faktoren, das ist jetzt auch sehr weit geholt aber doch, sind viele Apps, die diejenigen nutzen //mhm// auf dem Handy, die sie mir dann auch zeigen. Sag mal Frau Schmidt, das benutze ich, ist das in Ordnung oder also so übersetze ich, wenn ich manchmal frage, wie machen Sie das denn eigentlich? Und da merke ich, dass die mir manchmal auch was beibringen. Das ist dann auch äh für sie glaube ich motivierend. Aber da sehe ich, es gibt sehr viele Hilfsmittel, die denjenigen helfen. Translation by the authors.

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> And then I say, okay, there's this app, like I said, I don't know what it's called, and it's available in German, why don't you put your language on it? And suddenly they're all, wow look, it does the math, wow great. And then the terms are still there in Arabic or another language, mhm.[5] (Melanie)

The presence of paywalls restricting access to digital technology, however, emerged as a significant barrier, highlighting the financial constraints faced by both the institution and the students.

4. Discussion

Our two research questions focused on understanding some of the challenges and potentials of digital technology in learning and how these might differ based on learners' print and digital literacy skills. The two studies explored two different educational contexts in the larger German education system. While the learners in the two contexts varied greatly in their degree of print and digital literacies, the results show commonalities, as well as differences. In addition, we explored some of the dynamics between learners, teachers, and digital technology in education.

4.1 Teacher competence and digital training

Teacher digital literacy and teacher openness to incorporating digital technologies play a key role in the success of digital language learning (Wohlfart & Wagner, 2023). A common thread in both studies was the struggle to adapt to digital learning. Teachers felt that their preparation for intentionally implementing digital learning was inadequate and resorted to a "learning-by-doing" strategy. Such feelings of inadequacy at least partially derive from what research has indicated as a general failure to make digital learning a central part of teacher training (Fernández-Batanero, Montenegro-Rueda, Fernández-Cerero & García-Martínez, 2022; Lindfors, Pettersson & Olofsson, 2021; Polly, Martin & Byker, 2023). This aligns with the findings of the 2018 ICILS study, indicating that in the two years prior to the survey, only 31.5% of teachers had taken a course on integrating digital technology into teaching; 30.7%, a course on the subject-specific use of digital teaching and learning resources; and 26.2%, a course on application programs (Drossel *et al.*, 2019). More recently, Wintergerst (2023) found that 42% of students in Germany criticize their teachers for not knowing how to use digital educational media effectively in the classroom. Nevertheless, the COVID-19 pandemic appears to have had a positive effect on teachers' willingness to use digital tools in language learning (Maahs, Drews & Winter, 2021) and on their personal assessment of their own media skills (Robert Bosch Stiftung, 2024). Despite these positive developments, the full potential of digitality for language learning is far from being exploited and there is still a considerable need for professionalization (Gutenberg *et al.*, 2024).

As supported by the findings in the two learning contexts, lack of formal preparation hinders the formulation of learning objectives that effectively incorporate digital technology (Robert Bosch Stiftung, 2024). Apart from a few isolated examples, little digital learning was taking place until teachers were forced to do so by COVID-19 pandemic restrictions. Although the degree of print literacy and digital literacy among learners cannot be ignored, the common denominator shared by both groups of learners was that at least some of their minimal pedagogical use of digital technology related to the lack of teacher training in the informed and targeted use of digital technology. Yet, as illustrated by the case of the WbK, when teachers are provided with appropriate training, they will increase efforts to integrate digital resources into their pedagogy.

[5]Original: Und dann sage ich, okay es gibt diese App, wie gesagt ich weiß jetzt nicht wie sie heißt, und die gibt es auf Deutsch, macht doch mal eure Sprache drauf. Und plötzlich sind die ganz, wow guck mal, das rechnet ja, wow super. Und da stehen eben dann die Begriffe dann auf Arabisch oder äh ner anderen Sprache noch drin, mhm. Translation by the authors.

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This emphasizes the importance of incorporating digital literacy into all teacher preparation programs for the successful implementation of digital teaching and learning.

4.2 Access to digital technology for all as a social challenge

Digital technology can be seen as a two-edged sword. On the one hand, it can support different kinds of learning and boost motivation and engagement; on the other hand, digital technology can exacerbate the digital divide, especially when financial considerations come into play (Alam & Imran, 2015; Vassilakopoulou & Hustad, 2023). A recurring theme in both studies was the financial constraints faced by the institutions, such as a lack of Wi-Fi or up-to-date digital technology. This is supported by a recent survey in Germany (Forsa, 2023), finding that 50% of teachers were critical of the digital technology in their schools, despite improvements since the COVID-19 pandemic; that 68% of the students surveyed believed that their schools needed to be better technologically equipped; and that 87% of them felt that poor or non-existent Wi-Fi was the most pressing problem at their school (Wintergerst, 2023). Furthermore, when learners are required to provide their own digital technology, economic inequalities immediately surface. Many learners in both studies relied solely on smartphones, often with limited data plans. Most did not have the financial resources to invest in digital devices or in high internet data usage plans, underscoring the economic barriers to digital learning, regardless of learners' digital literacy.

4.3 Low print and digital literacies as limiting factors in the use of digital potential

The findings show that learners with emergent literacy and those with strong literacy differ with respect to learner autonomy. This was particularly the case in Study 1. The LESLLA learners showed a high reliance on teacher guidance and struggled to complete basic digital tasks autonomously since they were largely unfamiliar both with the written language of digitality and with the digital technology itself. This was exacerbated by their being unaccustomed to independent learning. Difficulties ranged from installing mobile applications to navigating digital technology to using these tools for meaningful learning. In contrast, the WbK learners with their stronger print and digital literacies and stronger educational backgrounds showed a high level of independent digital learning. These learners proactively sought out tools and opportunities for digital learning, even at times introducing teachers to new applications.

4.4 Potentials of digital technologies in language teaching

Both studies revealed potentials and opportunities for digital learning for both groups. In Study 1, WhatsApp emerged as a particularly beneficial positive tool for teacher–learner communication and collaborative autonomous learning. In line with other studies on LESLLA learners and digital technology, the use of smartphones and the voice features enabled the LESLLA learners to connect directly with each other and their teachers to support learning (Bradley & Al-Sabbagh, 2022; Eilola & Lilja, 2021; Norlund Shaswar, 2022). The use of these devices in learning also served to reduce anxiety, in contrast to the use of computers and other types of programs (Puebla *et al.*, 2022). In Study 2, the WbK teachers were aware of various digital technologies and reported an increase in efforts to integrate digital technology, demonstrating a willingness to explore digital technology as a pedagogical resource. This is in agreement with recent research indicating that 78% of teachers in Germany after the COVID-19 pandemic see digital devices as having positive classroom potential (Robert Bosch Stiftung, 2024).

In both studies, teachers felt unprepared and inadequately supported in making digital technology an integral part of their pedagogy. Nonetheless, although the teachers in both studies

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indicated that more could – and should – be done, they were optimistic that their learners had good opportunities to use digital tools for learning.

5. Conclusion

The two studies provide a better understanding of shared challenges as well as differences in digital learning by migrant adult learners at different levels of print literacy and digital literacy. One difference that stands out between the learners in the two studies is the degree of learner autonomy. As reported by their teachers, the LESLLA learners required much time and support in the use and application of digital technology. The WbK learners were more familiar and comfortable with independent learning. These learners and the teachers were able to share and mutually assist each other in their learning and in the use of digital technology for more individualized learning.

What we have presented here has broad applications for teaching and learning contexts in receiving countries serving often-marginalized migrant learner populations. Two of the most significant challenges in both studies were systemic: (1) the need for more comprehensive digital literacy in teacher education, and (2) the need for major improvements in school digital infrastructure. To overcome these challenges, in addition to increased funding, collaboration between the various stakeholders in education systems is essential. Globally, infrastructure and the capability to leverage digital technology for the 21st century effectively require cooperation and a mindset open to doing so among purveyors of teacher education programs, policymakers, financial decision makers, and school administrations. In so doing, important steps in addressing the digital divide and social inequities stemming from inadequate access to digital technology and devices and low digital literacy can be taken. To prevent the exacerbation of the digital divide and social inequities, all learners must have adequate access to and training in the use of digital devices and technology. In addition, teachers must be adequately prepared to promote the potential of digitality with explicit learning objectives. For language education, this can mean using digital media as linguistic scaffolds in the learning process (e.g. explanatory videos), as well as preparing learners for specific digital-related language activities (e.g. writing an email) that are important in everyday and/or professional life.

Supplementary material. To view supplementary material referred to in this article, please visit https://doi.org/10.1017/S0958344024000338

Data availability statement. Entire interview data available only on request due to privacy/ethical restrictions. Category system available within the article or its supplementary materials.

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