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Reviewing research on adult migrants' digital literacy: what insights for additional language teaching?

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This study presents a selective literature review covering the period from 2016 to 2023, focusing on research published in peer-reviewed journals, to examine what lenses researchers have employed in investigating the digital literacy of adult migrants and refugees. Three distinct research perspectives emerged: (1) reported digital use; (2) observed digital literacy practices; (3) designed digitally supported language teaching interventions. These perspectives complement each other in exploring how digital literacy can empower migrants to actively engage in the evolving digital landscape and facilitate language learning. The findings from a subset of 14 studies included in this review were categorized into a digital literacy taxonomy, aiming to inform language teaching practices tailored to the needs of migrants. This research addresses the urgent need for adapting language teaching and curricula in host countries to accommodate the increasing global migration and digitalization of learning. Additionally, suggestions for future research directions are provided to gain a deeper understanding of the specific digital literacy needs of this population and enhance the linguistic skills and social inclusion of newcomers.

Keywords: adult migrants and refugees, digital literacy, teacher education, additional language teaching

1 Introduction

A growing body of literature has been exploring how adult migrants and refugees rely on information and communication technologies (ICTs) to navigate a range of situations in the host country language, shedding a new digital light on traditional literacy (Malessa, 2021; Tammelin-Laine et al., 2020). Research on this population's digital literacy, defined as "the practices of communicating, relating, thinking and 'being' associated with digital media" (Jones & Hafner, 2012, p. 13), and its role in the development of their additional language (henceforth Lx¹), therefore responds to a social and societal emergency in countries that welcome migrants and refugees.

Several studies have suggested that Lx acquisition among migrants (this term will be used to refer to both migrants and refugees) appears to be closely

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linked to their digital practices in a society in which reading and writing are increasingly mediated by technologies (Alencar, 2020). Artamonova & Androutsopoulos (2020, p. 83) even underline that, for this population, “a prerequisite to successful social integration is not just learning the [additional] language, but also being digitally literate and thereby able to manage everyday tasks with digital tools.” Consequently, there is a need for scholars to better delineate suitable methods to research and improve the integration of digital tools in literacy and language programs offered to migrants and to adjust language teaching and teaching education to the ever-growing role of technologies in literacy development.

One of the first steps in addressing this research need is to conduct a literature review based on recent writings published after the onset of the '2015 European migrant crisis,' marked by a significant influx of refugees from Syria and other countries, predominantly into Europe. The aim of this present review, which is conducted from the vantage point of technology-enhanced language learning and teaching, is twofold: through the 14 studies that have been selected for this review, we first examine the perspectives, that is, the units of analysis (e.g., use, practice, learning) combined with the types of approach (e.g., report, observation, design), that have generally been employed by researchers in investigating the role of digital tools in literacy development. In line with Blin & Jalkahen (2014) and Cope & Kalantzis (2009), Table 1 provides a conceptual distinction between the three selected units of analysis.

	Digital use	Digital practice	Digitally-enhanced learning
Definition and focus	Individuals' range of use of digital tools, shaped by socioeconomic, cultural, psychological, and political conditions across contexts	The set of skills and attitudes that individuals progressively develop with digital tools in different (informal) out-of-school situations	The learning opportunities that are designed in formal school settings to enhance individuals' literacy potential with digital tools
Usually accessed through	Reports: what individual say they do (or think they do)	Observations: what individuals actually do	Experiments and interventions: how learning opportunities are designed (and sometimes assessed)

Table 1. Three units of analysis and corresponding methods.

The combination of diverse lenses into the study of migrants' digital tools use with methodological approaches seeks to foster analytical triangulation. This, in turn, should contribute to chart robust pathways for future research into adult migrants' digital literacy.

Second, in the discussion, the findings from these 14 studies are compiled and organised in three outcomes geared towards adjusting Lx teaching and teacher education in adult migrants' language learning. These outcomes comprise a tentative taxonomy of migrants' digital literacy, a schematic outline of migrants' digital landscape, and a proposed repertoire of Lx teacher attitudes and skills.

The article first examines the social and scientific background in which the issue of adult migrants' digital literacy emerges. The second section presents the methodological approach used to conduct the review. Analyses are then

presented and discussed with the lens of language education and future research directions are proposed.

2 Background

The number of people migrating globally continues to rise with an estimated 281 million international migrants in the world in 2020 according to the [World Migration Report](#) (2022) published by the United Nations. Economic reasons, but also the necessity to escape disaster caused by climate change, violence, persecution, and war are triggering this population movement, whether this occurs within an agreement from a given country to host an individual or a group of individuals, or without. Besides, between refugees who are forced to flee for their lives and immigrants who choose to live in another country for work or study reasons, the motivation to learn the language of the host country is impacted by such factors as the degree of stability of the migration status, individual life projects, the original level of schooling and literacy in the home country, and social, economic, cognitive, and psychological resources (Andrade & Doolin, 2016). What has nevertheless become common to both categories is the ownership of smartphones that accompany them during the migration process and mediates their social and cultural inclusion, as well as their Lx learning (Diminescu, 2020).

In the range of challenges represented by hosting migrants that do not share the language(s) of the host countries, the question of providing language and literacy courses to facilitate inclusion has become a priority for many governments (see for instance Canada's [Ontario Adult Literacy Curriculum Framework](#)). It is indeed commonly accepted that providing migrants with resources to develop their literacy, that is, their competence to read and write in the language of the host society, is a key element to their successful inclusion, particularly relating to their ability to find employment (Köhler, 2020, Hebbani et al., 2022), maintain good health (Traverso, 2017), but also, more critically, fully engage as citizens who have moved to "new and unfamiliar environments in which they need to construct meaningful lives" (Andrade & Doolin, 2016, p. 412). Language teachers thus play a key role in migrants' literacy development, but they often lack confidence "in their own ability to address learners' needs associated with digital literacies" (Tour, Creely, & Waterhouse, 2021, p. 301), certainly due to a lack of knowledge about migrants' digital usage beyond the classroom.

In the last years, several literature reviews have examined the role an array of technologies and smartphone applications play before, during and after migration. Alencar (2020) has recently provided an overview of studies focusing on refugees' lives across time and space (journeys, protracted displacement, and resettlement) and shown that their mobile communication practices intervene in a plethora of ways throughout the migration journey. Besides, the utilisation of mobile devices for language learning, commonly referred to as mobile-assisted language learning (MALL), has been suggested as a means to augment newly-arrived migrants' agency to learn the host country's language (Gillespie et al., 2018). For instance, Drolia et al. (2022) have carried out a literature review on mobile learning for refugees to compile the distinctive features of learning applications designed specifically for refugee populations between 2015 and 2020. Among the apps they reviewed, only 3 out of 14 were aimed at adult migrants' host language learning: *Ankommen* (Germany), *RefInfo* (the Netherlands), and *Minclusion*

(Sweden). Yet, because of the comprehensive process of the systematic review that examines learning from a general perspective, it was not clear in their review what aspects of language learning and digital literacy were targeted by these apps. Moreover, as pointed out by Bradley and Al-Sabbagh (2022), the existing apps frequently adopt pedagogical approaches that are “based on content transmission dressed up in gamified interfaces” (p. 14). Another literature review conducted by Potocky (2021) has examined studies published between January 2020 and April 2021 to identify emerging issues and research needs on refugees' digital literacy. Potocky concluded her review by noting that there is now a need “to develop, tailor, scale, evaluate, and sustain formal and informal, in-person and online digital skills training for refugees in integration” (p. 100).

Just as language skills have always been a key indicator of successful migrant inclusion, the same is true today for digital skills (Artamonova & Androutsopoulos, 2020). Yet, not only research has so far neglected adult migrants' digital literacy (Demmans Epp, 2017), but there is a substantial disparity in the approaches adopted to conceptualize digital literacy within the context of additional language education, as evidenced by scholars' use of the singular or plural form of the term 'literacy'. Caws et al. (2021) distinguish two main approaches. On the one hand, the functional approach refers to the ability to use tools effectively to perform a task in an Lx (e.g., producing a text in French with an automatic translator). This approach envisages digital literacies as culturally neutral and primarily performance oriented. On the other hand, the socio-cultural approach to digital literacy generally focuses on situated practices (Eilola & Lilja, 2021) involving digital technology that are shaped by social, cultural, historical, and political factors. Encompassing the ability to make appropriate use of digital tools in given situations, this second understanding of digital literacy also brings into play a set of dispositions and reflexive skills that enable individuals to construct new knowledge, communicate with others in given situations, and participate fully in all facets of social and civic life (Andrade & Doolin, 2016). Both approaches are relevant as they provide directions to build curricula and fuel teacher education. At the epistemological level, some authors envisage technology as playing an important but ancillary role in the development of traditional literacy and those who consider digital literacy as a different sort of literacy that needs to be studied separately. We propose that instead of treating literacy and digital literacy as distinct entities, a more promising approach consists in viewing them as interconnected and mutually reinforcing. Such a view rests on the premise that research in applied linguistics should both be able to provide a typology of digital literacies relevant to teachers when they plan interventions, but also contribute to a larger theoretical reflection on the role of literacy in migrants' learning trajectories across contexts.

The present literature review focuses on the role of technologies in adult migrants' lives from the angle of the learning of an Lx and developing one's literacy. The next section describes the steps that were followed to select articles in the published literature and examine methods and most salient findings on adult migrants' digital literacy.

3 Methodology

Because our focus is on language education, a selective literature review was chosen rather than a systematic one (see Templier & Paré, 2015 for an overview on research reviews). Systematic literature reviews, as the ones cited in the previous section, provide useful information about adult migrants' digital literacy

but do not always connect this information with Lx learning or they focus only on one pedagogical modality, as is the case with MALL. By selecting empirical studies among the existing literature, our aim was to (1) identify the main research perspectives that were used to study adult migrants' use of technologies in different personal, social, and learning situations that require reading and writing in an Lx and (2) infer, from the main findings, pertinent directions to inform language teacher education pertaining to the development of adult migrants' digital literacy. To carry out the literature review in line with other researchers (Acharya, 2016), the following steps were followed: (a) define criteria of inclusion and exclusion, (b) search for the literature in online journal and library databases, (c) perform relevance appraisal, (d) extract data, (e) synthesise studies, and (f) write the review.

The inclusion criteria concerned studies focusing on adult migrants' digital use, practices and literacy geared towards social and cultural inclusion and Lx learning published in peer-reviewed scholarly journals between January 2016 to April 2023, and written in English. Exclusion criteria were studies on migrants that were not empirically grounded (other literature reviews, tool or intervention descriptions, anecdotal evidence), that did not provide clear explanations about the gathering techniques deployed to produce data, and that did not directly or indirectly concern digital literacy and additional language learning.

The main scientific journals databases (ERIC, Scopus, JSTOR, SAGE, Taylor and Francis) were interrogated with the following key words:

'digital literacy', 'digital literacies', 'digital literacy events', 'digital use/usage', 'digital practices', 'technology-based language practice(s)', 'digital connectivity', 'new literacies', 'digital migration', 'adult' + 'less literate', 'low literacy', '(im)migrants', 'refugees', 'newcomers'

Besides, the lists of references from the studies included in our corpus were scrutinised to identify potential research that fell into the scope of the present review. Forty-six studies were identified in the initial search. Subsequently, their key components, such as the introduction, research questions, and method sections, were thoroughly examined. Three main reasons for rejecting articles included an emphasis on tools rather than literacies, a lack of robust empirical evidence, and outcomes that lacked relevance to the domain of language learning and teaching. For example, Kaur's (2016) article detailing the daily literacy routines of a former Syrian refugee was excluded from consideration. While it offered intriguing insights into a woman's Facebook usage, the content lacked the depth necessary to contribute significant original and relevant insights into migrants' digital literacy. This screening process aimed at ensuring a varied representation of methods and issues and ascertaining their potential to fuel reflection on teacher education.

Ultimately, 14 articles were shortlisted for the final review. In the final selection, only three articles dealing with adult migrants' digital literacy come from journals dedicated to research on the learning and teaching of foreign and additional languages (*Modern language Journal*, *Journal of Second Language Writing*, *Languages*). Three studies come from the field of applied linguistics (*Journal for Media Linguistics*, *Australian Review of Applied Linguistics*, *Information, Communication & Society*), three from the field of education (*Digital education review*, *Journal of Interactive Media in Education*, *Studies in the Education of Adults*), two from

information science, and finally one each from the fields of anthropology, ethnic studies, and cultural studies.

4 Findings

4.1 Overview of the studies included in the literature review

Table 2 shows the breakdown of the included studies by authors and journals, countries where the study was conducted, research questions, information about the participants, contexts of collection. The studies have been organised in alphabetical order.

Author(s) and journal	Countries where data were gathered	Research questions	Info about participants	Contexts of studies (in class or out of class)
Abou-Khalil et al. (2019) <i>Languages</i>	Lebanon Germany	What are the needs of Syrian refugees in Lebanon and Germany for learning languages using mobile language tools?	18 Syrian refugees in Lebanon and Germany, aged between 14 and 54, low level of literacy in Lx	Out-of-class
D'Agostino & Mocciano (2021) <i>Journal of Second Language Writing</i>	Italy	Which strategies do adult L2 learners with emergent literacy use to build up or enhance their written competence on Facebook?	10 young male adult migrants (from Sub-Saharan Africa) aged between 18 and 30 years, low level of literacy in Lx	Online (social media)
Eilola & Lilja (2021) <i>Modern language Journal</i>	Finland	How does the L2 learner use his smartphone as a cognitive artifact in pedagogical interactions?	1 focal male adult migrant from Syria with low literacy and some interrupted history of formal schooling in his country	Both in class and out of class
Artamonova & Androuso-poulos (2020) <i>Journal for Media Linguistics</i>	Germany	How is smartphone usage by asylum-seekers related to their linguistic choices in written or spoken language? How does their smartphone usage relate to informal learning of German?	6 = 2 families of refugees (Syria and Afghanistan) in Germany with varying degrees of literacy, aged between 15 to 56	At the participants' homes
Hebbani et al. (2022) <i>Australian Review of</i>	Australia	Do regular and meaningful written exchanges via asynchronous tools (Whatsapp) with expert speakers of host language	31 students from various countries, between the ages of 19 and 66 years	Outside the language classroom

<i>Applied Linguistics</i>		(English) supplement and/or enhance adult migrant's literacy and acculturation?		
Kaufmann (2018) <i>Information, Communication & Society</i>	Austria	How do Syrian refugees use their smartphones upon their first months in a new country?	10 Syrian refugees (4F, 6M)	Out-of-class and online (through WhatsApp)
Demmans Epp (2017) <i>Journal of Interactive Media in Education</i>	Canada	How do recent migrants appropriate various commonplace technologies by adapting their use to support their language-learning and communication needs across a variety of contexts?	18 migrants from various countries, aged between 21 and 65, 8 M, 10F	Out-of-class
Jones et al. (2017) <i>Studies in the Education of Adults</i>	UK	How do the participants use the tools and services provided within a mobile app to improve their language and communication skills and cultural understanding?	17 low-intermediate participants (5 men; 12 women) - only 11 participants had been in the UK for two years or less	Out-of-class (field trial of a mobile application)
Levinson & Barron (2018) <i>Digital Education Review</i>	USA	What language- and literacy-related media practices and activities do families engage in, either solo or together, as part of their daily routines? What family dynamics and practices develop around a newly introduced tablet device loaded with a small set of high-quality literacy and language resources?	3 low-income Latino families	At the participant's homes
Veronis et al. (2018) <i>Canadian Ethnic Studies</i>	Canada	What is the social media use behavior of newly arrived Syrian refugee youth, to facilitate their wellbeing, inclusion, and integration in Canadian society.	29 recently resettled Syrian refugee youths, 19 male and 10 female	Out-of-class
Andrade & Doolin (2016) <i>Management Information Systems Quarterly</i>	New Zealand	How does ICT use by resettled refugees contribute to their social inclusion?	53 individuals resettled in New Zealand, and who are recipients of a government-funded initiative that grants them a computer	At participant's homes or community locations
Köhler (2020) <i>The International Journal of</i>	Germany	Which information-seeking strategies do participants use? What barriers affect successful searching?	7 refugees from Syria and Iraq	Online (screen recordings)

<i>Information, Diversity, & Inclusion</i>				
McCaffrey (2019) <i>Annals of Anthropological Practice</i>	USA	How were recently resettled Syrian and Iraqi families in New Jersey using smartphone technology to facilitate communication in situ when language barriers remained otherwise present? How might their practices signal complementary ways for members of the host community to support newcomers' linguistic and cultural adaptation?	Newly resettled Syrian and Iraqi refugees in the USA (11 Syrian and 2 Iraqi families), low literacy	At the participants' homes
Neag & Supa (2020) <i>International Journal of Cultural Studies</i>	Sweden, Italy	What do young refugees' social media publications reveal of their emotional and communication navigation as they settle to a new host country?	16 unaccompanied young refugees (12 males, 4 females)	Online (social media)

Table 2. Overview of the studies included in the literature review.

All represented countries have massively hosted migrants and refugees in the last ten years (World Migration Report, 2022). In 8 papers out of 14, the studies² were conducted in Europe (Germany (3), Italy (2), Austria (1), Sweden (1), Finland (1), the United Kingdom (1)), followed by papers in Northern America (Canada (2), USA (2)), and in Oceania (New Zealand (1), Australia (1)). Interestingly, Abou-Khalil et al. (2019) gathered data both in Lebanon (place of displacement) and in Germany (place of resettlement) because they wanted to identify “the unique needs of refugees in different stages of immigration [...] to develop better language learning tools for refugees” (p. 71). Undoubtedly the so-called migrants' crisis that started in 2015 with the war in Syria (UNHCR, 2021) has spurred interest in the question of immigration; refugees from this country are the subjects of 6 studies out of 14. Other participants include Afghanis, Iraqis, Sub-Saharan Africans, and South Americans.

Most research questions are exploratory in nature (What are ...? How do...?), examining migrants and refugees' ICT, social media, or smartphone use, the strategies they harness, the dynamics that can be observed, - whether those are at the individual or the family levels, and the needs that emerge in terms of pedagogical, institutional or government intervention. From the most frequent to the least, the focus is on smartphone in-built functions (camera, voice recognition), smartphone applications (messaging), social media (Facebook), machine translation applications, search engines, and e-books.

The number of participants varies considerably, from one focal participant in Eilola and Lilja (2021)'s study to 55 participants in Hebbani et al. (2022)'s pedagogical intervention. The small number of participants in most of the studies can be explained by the fact that migrants are difficult to access and retain for research purposes (see Kaufmann (2018) for a discussion). Migrants' lack of time, mistrust towards authorities, political or economic vulnerability are various

reasons that are put forward to explain these studies' limited number of participants and the high rate of attrition. Besides, the in-depth understanding of their technology-enhanced literacy development requires finding brokers and incentive strategies to recruit participants, granting extra attention to ethical issues (e.g., translating consent forms, making sure participation and data remain anonymous), spending a lot of time to build rapport with them, using interpreters to gather conversational data in the migrants' home languages. All these strategies require time, funding, and effort and could explain the small number of studies with these populations and the limited number of participants.

Apart from Eilola and Lilja (2021) who followed one participant from *in situ* interactions at the market to the classroom, all studies were conducted out of class, at the participants' homes, in community centers, or during outings. In three cases, the studies were fully conducted online in the case of digital ethnographies or online experiments. It is worth underlining that there are no studies carried out in formal settings, certainly because of the high level of attrition of learners in these settings. Next sub-section will provide the detail for each of the 14 studies.

4.2 Overview of the research perspectives

One of the aims of this review was to identify the research perspectives that have been used to study the role of digital tools in migrants and refugees' literacy development. Research perspectives combine here the units of analysis (e.g., use, practice, learning) and the types of approach (e.g., reports, observations, designed interventions) that are presented in Table 1. Accordingly, this sub-section will briefly present the aim of each study, the gathering techniques that were implemented, and the most salient results.

First, five articles pertain to reported digital use, whether this concerns ICT, smartphones or social media. Second, five studies capturing the dynamics of digital literacy practices are presented. Finally, four studies that scrutinize the design of digitally supported Lx teaching interventions are described. Table 3 provides a summary of the studies according to the adopted perspective, their themes with highlighted keywords, and the data that were used by the authors.

Table 3 : studies according to methods

	Author(s) and journal	Themes	Data
Reported digital use	Veronis et al. (2018)	Newly arrived Syrian refugee youth' social media use and its contribution to their wellbeing, inclusion, and integration	Focus group discussions
	Andrade & Doolin (2016)	Resettled refugees' ICT use and its contribution to their social inclusion	Interviews
	Abou-Khalil et al. (2019)	Identification of Syrian refugees' needs for learning languages using mobile language tools	Group brainstorming sessions
	Demmans Epp (2017)	Newly arrived migrants' appropriation of various technologies to support language-learning and communication across contexts	Interviews after a three-week deployment of a mobile tool Interviews

	Kaufman (2018)	Newly arrived Syrian refugees' smartphone use	Interviews, day-long follow-up chats in WhatsApp and research assistant's interview
Observed digital literacy practices	Artamona & Androutsopoulos (2020)	Asylum-seekers' smartphone use for informal learning of German and communication	Fieldnotes, interviews, video recordings of mobile phone use
	D'Agostino & Mocciaro (2021)	Adult L2 migrants' strategies on social media	Facebook posts and interactions
	Neag & Supa (2020)	Young refugees' emotional work and communication navigation on social media	Facebook posts, photos and videos
	Levinson & Barron (2018)	Latino migrant families' media practices and dynamics at home	Observations and interviews + an intervention (introduction of a tablet with curated content)
	McCaffrey (2019)	Resettled families' smartphone use for in situ communication and cultural adaptation	Observations and interviews, texted communication
Designed digitally supported Lx teaching interventions	Jones et al. (2017)	Evaluation of migrants' use of a mobile app to improve language, communication skills and cultural understanding	Field trial of a mobile application
	Hebbani et al. (2022)	Evaluation of adult migrant's WhatsApp exchanges with expert speakers of host language to enhance literacy	Pre-test and post-test, interviews
	Köhler (2020)	Evaluation of migrants' online information seeking strategies	Dynamic screen capture of online search tasks
	Eilola & Lilja (2021)	A focal migrant's use of his smartphone in pedagogical interactions in and out of class	Video recordings

4.2.1 Reported digital use

This sub-section presents five studies that complement each other and provide an overview of digital use by adult migrants. Digital use here refers to how different digital resources (ICT, smartphone and social media) are harnessed in different out-of-class situations according to migrants' verbal reports.

Thanks to focus group discussions, Veronis (2018) examined how social media and smartphone applications contributed to 29 newly-arrived Syrian refugee youth's wellbeing, inclusion, and integration in Canada. As an example of smartphones as a "virtual space for transcultural communication" (p. 83), Veronis notes that a Muslim participant used an application while grocery shopping to scan products and verify that they were free of pork, obtaining the results in Arabic. This provides anecdotal but interesting evidence that, even with no or little command of the host language, smartphone applications can provide help to migrants to decipher a new cultural and linguistic environment. Veronis

concluded that digital tools are an effective means for fulfilling immediate settlement requirements by providing migrants with practical information concerning everyday life in their host country, for instance to locate services and educational opportunities.

Kaufmann (2018) conducted research with ten newly arrived Syrians in Austria. Her investigation unfolds in three phases. She first interviewed participants about their smartphone use (as an example of questions, she asked them to name the five most important apps on their smartphone). She then used a technique described as ‘mobile instant interviewing’ (p. 885), that is the study of digital use over the course of a day during which the researcher repeatedly asks what the participants are doing via WhatsApp. Finally, she included an interview with a research assistant, from the same community, who served as a linguistic and cultural broker with the participants. Kaufmann proposes four main categories of digital use: geographical orientation and place-making, language learning and everyday translation, information access and self-help, and maintaining communication with family.

Andrade and Doolin (2016) conducted interviews with 53 participants resettled in New Zealand to determine how Information and Communication Technologies (ICT) contribute to their social inclusion and facilitate “opportunities for their participation in social, cultural, political, and economic life” (p. 406). The authors define social inclusion as “the right of persons to the capabilities that they value in constructing meaningful lives” (p. 405). Their approach underlines the potential of going beyond functional literacy as is often the case in use studies, and results in the identification of five capabilities that ICT use offers refugees. These encompass participation in an information society, effective communication, understanding of a new society, social connection, and the expression of a cultural identity. Andrade and Doolin’s findings also shed light on why asynchronous technologies, such as email and WhatsApp, are highly favored among refugees, as they minimise the likelihood of misinterpretation and alleviate the stress associated with daily interactions in an unfamiliar language.

The article by Abou-Khalil et al. (2019) adopts the perspective of designers of pedagogical solutions (mobile applications for smartphones) designed to meet the needs of Syrian refugees during their passage through a country of transit and their resettlement in a host country. Interestingly, they enrolled 18 refugees in participatory design workshops so that the identified needs could be directed towards tailored techno-pedagogical solutions. Their results could be applied to any person wishing to learn an additional language in an immersion context (e.g., time management, need for self-discipline and motivation), even though the social and economic status of most refugees and migrants make these obvious needs less easy to attain. The authors have also identified refugees’ “need for contextual vocabulary learning”, which according to Abou-Khalil et al. (2019) could be explored further by collecting and analysing jointly digital dictionary search and location data to better understand the “lexicon that the refugees are potentially interested in learning in specific contexts” (p. 14).

Finally, Demmans Epp (2017) interviewed 18 migrants from various countries recently arrived in Canada to determine how they appropriated diverse technologies by adapting their use to support their language-learning and communication needs across a variety of contexts. For instance, her study uncovered that “migrants used Google image searches to gist vocabulary meanings and Wikipedia articles to understand vocabulary that is more advanced”

(p. 7). She concluded that, without help, the participants mainly used tools to support “narrow learning tasks” (p. 11), like vocabulary learning, but that socio-technical solutions and teacher support were necessary to provide them with socio-collaborative opportunities to use their additional language in more meaningful ways.

4.2.2 Observed digital literacy practices

Five ethnographic studies, two in the tradition of social media ethnography (Postill & Pink, 2012) and three in the tradition of home literacy ethnography (Shi, 2012), are used to examine migrants’ digital literacy practices. These are defined as migrants’ digital literacy dynamics observed in different online and offline situations over significant periods of time.

At the intersection of social media study and ethnography, Artamonova and Androutsopoulos (2020) conducted a study with two Syrian and Afghan refugee families in Germany, whose members possessed varying degrees of literacy. Combining ethnographic fieldnotes, interviews, and video recordings demonstrating participants’ samples of smartphone use, the authors report on the digital practices of the participants through “mediagrams”, which are visualisations of the languages, modes (oral, written, multimodal) and media (e.g., WhatsApp) participants made. The authors point out that the affordances of smartphones allow refugees to manage daily routines that are essential for arriving in a new country: using machine translation applications to search for useful information (health, employment, housing), finding routes on Google Maps, communicating with schools and teachers, maintaining contact with old and new social networks. Their study concludes that “a prerequisite to successful social integration is not just learning the dominant language, but also being digitally literate and thereby able to manage everyday tasks with digital tools” (p.83).

D’Agostino and Mocciaro (2021)’s article focuses on ten African migrants in Italy that they observed for two and a half years through their publications on Facebook to examine their strategies seen “as a continuum of progressive autonomy in the use of written forms” (p. 14). Copy-pasting, imitation, and re-use of other emergent writers’ fragments on Facebook are identified as frequent practices that participate in their developing literacy. In the same vein, but lasting only for a month, Neag and Supa (2020)’s article examined how 16 young refugees, from African and Middle Eastern countries resettled in Europe, displayed their emotions (e.g., loneliness, joy, longing) on Facebook and how their activity on social media was a way to “maintain and establish new connections and networks of belonging, blurry boundaries between absence and presence, and experience reciprocal support [with fellow migrants]” (p. 781). Such social media ethnography provides a useful and unobtrusive perspective on a given community’s literacy development. Accessing a community of migrants through their social media activity thus represents a rich way to explore their process of transition into the host country through the semiotic resources they use (pictures, posts), as well as the interactions they participate in (likes, comments). Yet, D’Agostino and Mocciaro warn,

“Facebook may not reflect learners’ (linguistic and writing) competence. Rather, for some learners (and at certain stages of writing acquisition), social media represents “a locus of immersion in the written language, in which learners imitate and re-use the linguistic fragments to which they are exposed” (p. 15).

Levinson and Barron (2018) and McCaffrey and Taha (2019) adopted similar home ethnographic approaches; they paid regular visits to migrants in their homes (three low-income Latino families resettled in California in Levinson and Barron's case and 11 Syrian and Iraqi families resettled in Northern New Jersey in McCaffrey and Taha's). In both cases, researchers conducted observations and discussions about the participants' digital use and the roles and attitudes of parents and children in the literacy practices and the intergenerational dynamics at work. As neither McCaffrey nor Taha were fluent in Arabic and as they came without an interpreter, their visits resulted in meaningful interactions in which digital tools were employed, foremost among which were machine translation applications like Google Translate and asynchronous communication tools like WhatsApp. This helped them to understand that "using the smartphone for on-the-spot [...] slowed communication" (p. 31). Yet, despite these limitations, McCaffrey and Taha underline that "smartphones provide rich possibilities for facilitating integrative work with resettled refugees during difficult early periods of adjustment" (p. 35).

For their part, Levinson and Barron (2016) show that homework, in some migrant families, can lead to the emergence of collaborations between parents and children where different technological tools can play an agentive role in giving parents back a role in their children's education. It should be noted that after three months in Levinson and Barron's ethnography, an iPad with educational resources (curated language- and literacy-related content) was given to the families to observe how enriched practices could develop. Several literacy events (for instance joint reading) provide convincing "examples of the expanding intergenerational and bi-directional learning/teaching relationships within and across families [that] hint at the potential for intentionally designing family learning opportunities to allow parents to share practices with one another" (p. 165).

4.2.3 Designed digitally supported Lx teaching interventions

This last section includes four studies (one experimental task and three interventions) designed to engage migrants in digitally supported tasks geared towards Lx learning.

Köhle's (2020) article asks what strategies can be deployed to search for information in a search engine to find a job. The researcher used screen video recordings from an online experimental task to describe the strategies of seven adult refugees. Although the article makes the connection to job search, very little information is given about the instruction given to the participants and what defines the complexity of the search task. Yet, the study identifies three strategies (that is, "suggestions", "copying", and "autonomous formulation") for query formulation. Köhler concludes that "any suggestions made by the search engine were readily accepted and [...] the participants did not seem to follow a specific self-developed plan" (p. 111). Such a study signals that research on digital literacy required for specific tasks could inform additional language teaching. Strategies to use commonplace digital tools (like Google search engine) can be taught so that learners use them to the fullest of their potential but are made aware of their limitations.

The article by Jones et al. (2017) presents the field trial of Mapp, a mobile application that was specifically designed for the adult migrant population as part of the European MASELTOV project. This app offers learners the possibility

to scrutinize on scrutinized learning as it uses the city environment as the main resource. The data were gathered through post-use interviews (what the users say they have done), and not through traces of *in situ* learning, which would have allowed to understand when, where and how the application was used. Participants reported using the application more when they were in the private space of their homes than when they were on the go, which perhaps highlights that mobile assisted language learning is not always as mobile as educators would imagine. Jones et al. conclude that “learning while walking around a town [...] is predicated on very short learning episodes in complex and dynamic environments” (p. 247). The study also provides an excellent example of a tool that is specifically designed to cater to the needs of migrants and could thus be a blue-print for further research-development.

Hebbani et al. (2022) implemented an action research project with an asynchronous tool (Chatloop) connecting 31 newly arrived migrants in Australia with volunteers. These were expert users of English that were previously trained to provide comprehensible input and negative feedback. Following an approach favouring 80 scrutinized 80 d and genuine communication, partners exchanged written and audio messages via WhatsApp for five days before being paired off with someone new. In relation to what is actually learned by the participants through the exchanges, the statistical tests that are conducted, through a pre- and post-test, to evaluate the impact of the project are not significant. The project, nevertheless, gives learners the rare opportunity to read and write in English, gain confidence and understand crucial aspects of the host culture. It also provides a remarkable example of intervention that could be led to offer meaningful technology-enhanced interactions to newcomers.

In a very enlightening study, Eilola and Lilja (2021) describe the role the smartphone can play as “a personal cognitive artifact” for migrants in Finland. The data come from a pedagogical task that was designed to help migrants to “participate in interactions and learn from them” (p. 295). During an excursion at the marketplace, learners were asked to interact in a range of service encounters, film them and use these clips for subsequent in-class study of language-in-use. The study focuses on Ali, a migrant from Syria with emerging literacy but “exceptional [...] smartphone use for language-learning purposes” (p. 298). Using the conversational-analytical frame, the authors show how the smartphone is harnessed by Ali to translate, curate and memorise language elements (asking a question about opening hours). The multimodal transcript allows the researchers to track Ali’s cognitive work in situ and in class while the trace of his interaction with an ice-cream seller is discussed with his peers. Eilola and Lilja’s fine-grained analysis provides us with a “trajectory of learning” (p. 299) that convincingly demonstrates that some functionalities of the smartphone, when used strategically across formal and informal contexts, can support language learning. This study differs from the usual study of technology by learners because the participant’s use of the smartphone in the interactions is not prompted by the language teacher but emerges during the interaction.

5 Discussion

In this section, findings are summarised and discussed. Then, implications for Lx teaching and teacher education and for future research directions are delineated. Finally, some limitations are acknowledged.

5.1 Summary of findings

The study of migrants and refugees' reported use of ICT, social media, and smartphone is important as it identifies common literacy functions, and signals potential needs. They provide useful directions to language educators, although they rarely establish a clear link between digital literacy and Lx learning. The observation of digital literacy practices is certainly powerful in capturing literacy changes and dynamics and providing "an understanding of the complex, interrelated factors acting in a home literacy environment, such as the learning context, family language use, cultural influences, and community practice" (Shi, 2012, p. 236). Finally, intervention studies are useful to provide directions in digitally supported Lx learning and teaching, as their findings directly resonate with the practical needs and concerns of language educators, offering actionable insights for improving instructional practices. At a time when the reflection on technology-enhanced additional language learning and teaching to adult migrants is still in its infancy (Tour et al., 2021), all three types of perspectives seem useful to understand the socio-technical contexts migrants move in, the literacy practices they develop formally and informally, and examine the emerging experiments that pave the way for richer integration of digital literacy in Lx classes.

Figure 1 summarises the findings from the literature review and provides a tentative taxonomy of digital literacy. While not intended to be exhaustive or universally applicable, this taxonomy provides a list of the different literacy practices that can be developed informally across personal, social, and professional contexts by migrants and refugees, whether it is offline (using *Google Map* to find one's way in the host city) or online (e.g., consulting a government site to find official information on migration status). Literacy practices have been ordered according to (1) their perceived complexity and (2) the required level of engagement within the host culture.

Out-of-class migrants' digital literacy practices
Maintain communication with family
Orient oneself geographically and semiotically
Access and process daily life information
Access and process crucial information
Get familiar with host culture through online media
Play one's role as a digitally capable parent
Manage routine digital written interaction
Manage crucial digital written interaction
Engage online as a citizen and community member
Express one's identity online
Participate in host culture

Figure 1. taxonomy of adult migrants' digital literacy

Some literacy practices (e.g., maintain communication with family) can manifest themselves in languages that are already known and not in the official language(s) spoken in the host country, others (e.g., express one's identity online) in a

combination of languages, while a last group can only be performed in the Lx (e.g., manage high-stake written interactions). The development of this taxonomy owes a lot to Levinson and Barron (2018) and Andrade and Doolin (2016)'s texts in going beyond functional digital literacy, without neglecting their crucial importance for newcomers, and including digital practices pertaining to parenthood, citizenship, creativity, and identity work. This taxonomy has the potential to guide curriculum design, enabling the adaptation of language teaching approaches to address the diverse challenges encountered by migrants across various contexts.

Figure 2 categorises various digital resources, such as social media like Facebook as evidenced in D'Agostino and Mocciaro (2021), tools like the iPad as exemplified in Levison and Barron (2016), applications like WhatsApp as observed in Hebbani et al. (2022), and instructional tools like Jones et al. (2017)'s Mobile-Assisted Language Learning (MALL) scenario. Together, they form an ensemble of media, texts, and instruments that create a complex digital landscape for migrants, especially those who have a low literacy level as they are confronted, at the onset of their migration process, with the need "to navigate increasingly detached and impersonal administrative websites" (Diminescu, 2020, p.5).

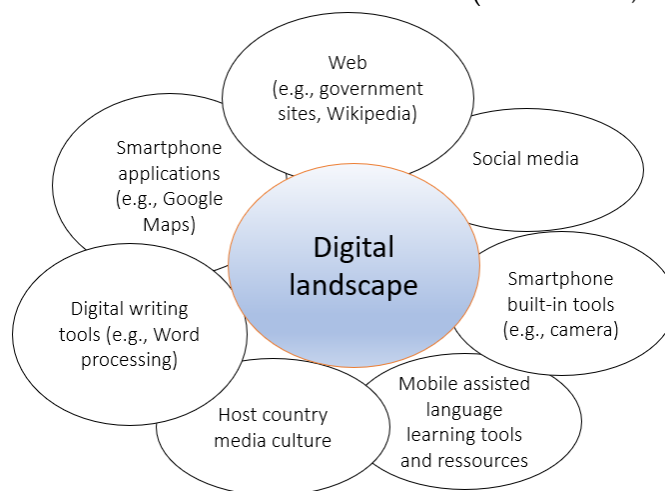


Figure 2. Migrant's digital landscape

The host country media culture has also been added to this ensemble because any national context provides an ideological backdrop that shapes tools and how they are used for social communication.

Most reviewed articles underline the central role of the smartphone and its many applications for migrants' developing literacy. The role of mediating hub of the smartphone should be acknowledged by language teachers and educators who are often wary of the omnipresence of this tool in classrooms (author, 2019) and not always ready to dwell on migrant learners' existing repertoires when teaching digital literacy (Tour et al., 2021). The review has allowed to pinpoint a host of literacy functions that smartphones and other digital tools can help fulfill (e.g., identity work, orientation, documentation, curation, correction, translation, copy-pasting, checking, rehearsing). It has also uncovered language learners' emergent literacy strategies in using digital affordances that are "generally ignored in formal acquisition contexts" (D'Agostino & Mocciaro, 2021, p. 15).

5.2 Implications for Lx teaching and teacher education

Figure 3 consists of an extrapolation from the analyses and presents teaching attitudes and interventions that could facilitate migrants' digital literacy development in an Lx.

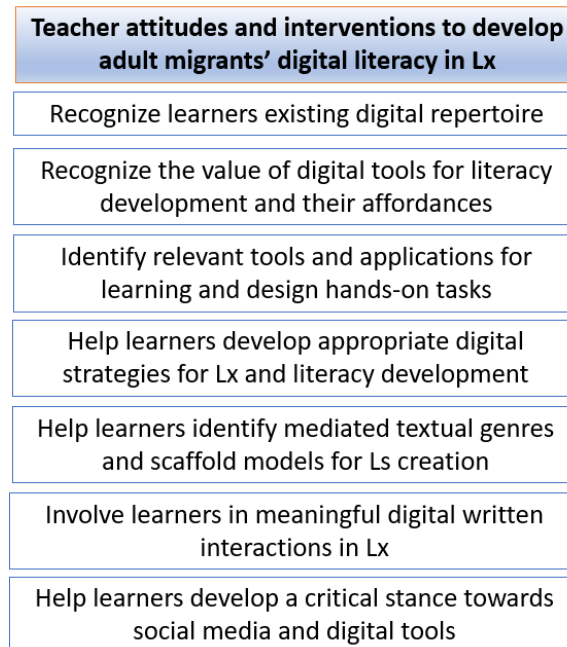


Figure 3. toward Lx teacher enriched repertoire of attitudes and skills

These directions could enhance pedagogies that scrutinize the central role of digital tools and resources in migrants' lives and their affordances to enrich, in a guided manner, informal literacy that is developed with varying degrees of efficiency, strategy, creativity and criticality outside the Lx classroom.

If, as underlined in the previous section, digital tools contribute significantly to newcomers' literacy, the vernacular knowledge that is built informally is only a first step on the road to digital literacy in an Lx. To facilitate and enhance the process, language teacher guidance in formal settings is needed and could adhere to some of these directions:

- recognise and promote migrants' repertoires of digital practices-- comprising those deployed at home, at work, as parents or as community members, and build connections between them and guided learning;
- co-construct with learners a selection of digital tools and smartphone applications that are pertinent for literacy purposes, and progressively get learners to "intentionally curate valued content" (Barron & Levinson, 2017, p. 166);
- help learners be more critical vis-à-vis unreliable information and social media;
- encourage students to use their smartphones in class whenever they feel their help might be relevant and develop their expertise about the timeliness of use or lack thereof;
- make students aware of tools' affordances and limitations for all functions they can fulfill (e.g., search information, write synchronously and

asynchronously, translate, revise) and design activities to develop strategic and efficient use;

- design appropriate pedagogical activities to help learners become confident communicators by getting them to interact strategically with digital artefacts in significant situations and reflect upon the process;
- involve students in communicative, expressive, and creative activities, and not only in low-level functional activities.

These different directions could be used to inform pre-service and in-service teacher education and help teachers shape their professional stance and repertoire towards the development of digital literacy with adult migrants, an aspect that is still neglected in most language teacher education programmes (Malessa, 2018).

5.3 Future research directions

Three main directions can be identified to further orient research on adult migrants' digital literacy to gain a better understanding of (1) the populations of migrants' commonalities and specificities, (2) the contexts of technology-enhanced language use, and (3) migrants' specific digital needs.

Firstly, migrants are not a homogeneous group, and neither are their lived experiences. Consequently, we follow Dixon and Wu (2014), who claim that research needs to be conducted:

“on a variety of immigrant populations in a diversity of contexts [so] that researchers and educators may be able to more clearly disentangle which issues are common to experience of immigration, which is common to second language acquisition, which is as a result of specific policies or school contexts and which are culture-specific.” (p.442-443)

This heterogeneity of experiences also entails examining factors like gender (Veronis et al., 2018), ethnic background, varying degree of literacy, sexual orientation (author, 2021), in brief, migrants' “diverse experiences and multiple identities” (Neag & Supa, 2020). It is not only important to look at them individually, but also cumulatively, to determine how they contribute to shaping digital literacy. This requires attention to strategies in building samples and sensitivity to cultures. For instance, faced with the difficulty to reach women among Syrian refugees, Abou-Khalil et al. (2019) have scrutinized focus groups where men and women were separated “to provide the women with more space to express their unique personal thoughts and experiences” (p.6).

Secondly, studying the contexts of technology-enhanced language use, outside formal schooling, remains necessary to finely grasp the different facets of digital experiences and the assemblages of tools and literacy that are built to scrutinize “the agency migrants can exercise in diverse contexts” (Gillespie et al., 2018, p. 3). We have acknowledged that ethnographic research can be instrumental in capturing the emergence of digital literacy across time and space. Yet, because significant periods of time are needed by ethnographic research, alternatives consist of examining “learner-led activities and learners' practices in informal mobile language learning” (Jones et al., 2017, p. 230) leading to deduce “what types of knowledge are needed in order to effectively engage in given literacy practices” (Perry, 2012, p. 55). Starting from situated digital use for Lx could thus

help bridge the disconnects between migrants' daily experience and school (Levinson & Barron, 2018). Digital resources could then be integrated in formal classroom instruction in "a pedagogically reasonable way" (Tammelin-Laine et al., 2020, p. 86).

Thirdly, adult migrants have specific needs including developing noticing skills, self-regulation and directions to one's learning (Demmans Epp, 2017), getting just-in-time provision of words according to contexts (Abou-Khalil et al., 2019), being involved in opportunities to safely practice communication skills and get positive and negative feedback (Hebbani et al., 2022). As experimental research remains rare (only Köhler's article among the 14 that were scrutinized), protocols examining adult migrants' strategies in using machine translation tools, word-processing, online dictionaries and speech-to-text applications, among other tools and applications, are needed to complement the existing knowledge concerning this population's literacy needs. Research should also help uncover migrants' needs that can be tied in with the language and literacy curricula that are proposed by host countries and continue to fuel the emerging research on digitally enhanced language learning and teaching (Tour et al., 2021).

5.4 Limitations

In this review, migrants and refugees have been placed on an equal footing. Yet, if they are faced with similar challenges, migrants might have more time and reasons to invest in the development of their literacy than refugees who do not know if the country in which they are staying will be their final destination and if it is worth learning the language spoken locally or resort to English as a *lingua franca*. The trauma and vulnerability of the refugee population set them apart from that of the migrants and they deserve focused scientific and social attention.

In addition, the choice to solely include studies published in English and available in peer-reviewed journals has led to neglect grey literature or research published in languages other than English. Moreover, despite adhering to a transparent selection process (see section 3), undertaking a *selective* rather than a *systematic* literature review inherently results in the inability to eliminate the researcher's subjectivity.

Finally, a literature review can only provide a snapshot of an issue at a given moment. As "technology evolves more rapidly than academic publications" (Potocki, 2021, p. 101), certain tools, such as AI-powered tools like ChatGPT, do not yet appear in this review although their potential for Lx learning becomes evident.

6 Conclusion

This article provides an overview and analysis of the current body of literature concerning migrants and refugees' digital literacy, delineating three complementary perspectives, (1) reported digital use, (2) observed digital literacy practices, and (3) designed digitally supported Lx language learning and teaching interventions. It also examines implications for teachers and teacher educators and indicates a few research directions. As we have seen, technology plays a crucial role in enhancing traditional literacy skills, as it provides migrants with new platforms for accessing, processing, and sharing information in an Lx. Besides, digital literacy empowers migrants to become

active participants in today's constantly evolving digital landscape and, as such, requires to be fully integrated in literacy education curricula and the preoccupations of policymakers in charge of migration (Tammelin-Laine et al., 2020).

Finally, the scarcity of research focused on the role of technologies for migrants' language and literacy development, already deplored by Malessa (2018), can only be confirmed by this literature review. It can be also noted that the top journals dedicated to second language learning and technology (e.g., *System*, *ReCALL*, *CALL*, *Language Learning & Technology*) are so far completely absent from the list, which comes in stark contrast with the large number of publications that focus on international students' digital literacy in language learning in the same set of journals. While international students form a privileged group of migrants that generates a high revenue for universities and allows Lx researchers to work on sophisticated literacy practices, migrants' literacy needs are generally catered for by short programmes far from the hearts of prestigious campuses and away from most researchers' scope. Therefore, specific research programmes, special issues and extra funding are needed to counterbalance this lack of attention and blatant inequality and to address further the role of digital tools in migrants' literacy.

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Endnote/s

¹ As migrants and refugees frequently possess a multilingual repertoire (D'Agostino & Mocciano, 2021), the term additional language (Lx) is preferred to that of second language.

² Note that some studies were conducted in several countries.

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