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RESEARCH ARTICLE

Migrants' digital skills development: Engaging with and creating digital cultural activities on the ENACT web app

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Abstract

Migrants encounter multiple challenges, such as learning new languages and adapting to a new life. While digital technologies help them learn, limited research has been conducted on their digital skills development. In this article, we report on migrants' digital skills development while learning language through culture using a web app developed by an EU-funded project that aimed to promote social cohesion through a two-way exchange of knowledge and skills. Forty-six migrant and 43 home community members in Finland, Spain, Türkiye, and the UK participated in intercultural and intergenerational pairs to engage with and co-create interactive digital cultural activities in multiple languages. Participants' digital, linguistic and cultural gains were measured before and after the workshops. We report on participants' digital skills, measured by a digital competence self-assessment tool developed based on DigComp, and interviews with the participants. Quantitative data were analysed using descriptive and inferential statistics. Qualitative data were analysed deductively using the categories of the DigComp framework. Findings indicate statistically significant improvement in migrants' self-reported digital skills. Highest gains were in the

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competency area of digital content creation. Comparison of migrants' digital skill development with that of home community members did not show any statistically significant differences, supporting our argument against the deficiency perspective towards migrant populations. Interview data suggested overall positive evaluations and highlighted the role of the web app instructions for content creation. We conclude with suggestions for further research and argue for inclusive pedagogies, emphasising how both community members learned *from* and *with* each other during the workshops.

Keywords: migration; digital skills; learn language through culture; digital cultural activities; ENACT web app

1. Introduction

Migrants[1] can be seen from a deficiency perspective, as lacking resources or being disadvantaged compared to host communities (Kea, 2023). Migrant students may be viewed as deficient due to limited language proficiency, leading to social isolation from home students (Tran, 2015). Research shows that "students from immigrant backgrounds tend to perform worse in terms of several educational outcomes" than home students, "even after controlling for socio-economic factors" (European Commission: Joint Research Centre & Rodrigues, 2018: 6). However, in digital skills, both migrant and home students show similar competence levels, with some variation across European countries. While migrant students, especially first-generation migrants, may begin using digital technologies later, by age 15 they generally catch up and often use these technologies more intensively for education (European Commission: Joint Research Centre & Rodrigues, 2018). Therefore, a strength-based approach (Tour, Creely & Waterhouse, 2021) to teaching digital literacies could improve migrant students' educational outcomes and reduce achievement gaps, "by, for instance, facilitating the learning of the language of the host country" (European Commission: Joint Research Centre & Rodrigues, 2018: 6).

Migrants need a variety of skills for successful social integration, including cultural, linguistic, social, and practical skills related to employment, housing, education, health, and citizenship. Social connections, safety, stability, and language and cultural knowledge help overcome integration barriers (Ager & Strang, 2008). Digital literacy training also facilitates integration by supporting displaced individuals in their search for employment. Successful participation in the labour market is important to create positive relations or "social bridges" between host and new communities (Ager & Strang, 2008; Ahmad Ali *et al.*, 2022). Digital skills can enable migrants to access welfare and healthcare systems as well as online educational opportunities independently (Phillimore, D'Avino, Papoutsi, Strain-Fajth & Ziss, 2022). Use of smartphones assists migrants' language learning outside the classroom, enabling societal participation (Eilola & Lilja, 2021). New social networks are vital for isolated migrants (Ganassin & Young, 2020). For instance, for older Congolese refugees in the US, digital skills helped maintain their social network both in the new community and in their countries of origin (Pachner, Schuman & Parekh, 2021).

A common teaching goal in many language programmes is developing digital literacy skills (Godwin-Jones, 2015), because language learners need digital abilities to communicate effectively in multimodal, multilingual online spaces (Dudeney & Hockly, 2016). This requires a multiliteracies approach to language learning (The New London Group, 1996). In an increasingly digital era, digital tools help migrants learn languages and cultures (Bradley & Al-Sabbagh, 2022; Eilola & Lilja, 2021; Guichon, 2019; Kukulska-Hulme, 2019; Nteliou, Koreman, Tolskaya & Kehagia, 2021), playing a pervasive role in the social, cultural, and linguistic adaptation of

[1]There is no universally accepted legal definition of "migrant", which includes groups like economic migrants, foreign students, internally displaced persons, and asylum seekers (see Douglas, Cetron & Spiegel, 2019, for an extensive discussion about the term). In this project, "migrant" refers to individuals who have left their place or country of origin and resettled in the specified countries. Participants were not asked to disclose their legal status, and the study does not focus on legal status differences. Participant demographics are presented in Table 2.

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international students (Guichon, 2019). Translation and vocabulary apps support the integration of newly arrived migrants (Hashemi, Lindström, Bartram & Bradley, 2017), but decontextualised content and repetitive exercises largely built on repeating and completing tests of vocabulary items in many language apps fail to engage learners (Bradley & Al-Sabbagh, 2022). Instead, mobile apps should foster "genuine interest in learning the second language in order to come closer to the other language community" (Gardner, 2001: 5) by connecting to social aspects and using learners' first languages. Kukulska-Hulme (2019) highlights the need to expand the range of mobile tools that cater to migrants' language learning needs by generating "innovative options through the active involvement of migrants in learning designs" (p. 117).

While mobile technologies aid language acquisition for migrants (Bradley, Bartram, Al-Sabbagh & Algers, 2023), it is unclear to what extent engagement with technology-enhanced language learning tools develops migrants' digital skills. There is also little research on digital skills development of migrants through creating their own (rather than consuming) digital products, such as digital stories (Sawhney, 2009). Additionally, integration is increasingly recognised as a complex, two-way process of mutual accommodation (Ahmad Ali *et al.*, 2022). Migrants face challenges like learning new languages and adapting to a new life while preserving their cultural identity (Hashemi, Lindström, Bartram & Bradley, 2017), but host communities also face the challenge of learning about migrant languages and cultures (Sancho-Pascual, 2020).

In response to these gaps in research and in available functionality of digital technologies, the EU-funded ENACT project[2] developed a web app (https://www.enacteuropa.com/) to create informal learning experiences outside the language classroom with the overall aim to support integration through two-way sharing of digital, cultural, and linguistic knowledge and skills between migrant and home communities. The web app has a responsive interface, so it will work equally well on mobiles, tablets, and computers. It was co-developed with the target migrant populations to meet their needs (Kharrufa, Satar, Bone Dodds & Seedhouse, 2022). It supports users with no expertise in pedagogy, media, and/or technology in creating contextualised digital content for language and culture learning. The project members organised workshops in Finland, Spain, Türkiye, and the UK between intercultural[3] (migrant and home community members) and intergenerational (first- and second-generation migrants) pairs. Using the web app, participants explored, re-enacted, and co-created interactive digital activities from both communities in their own languages.

In this article, we focus on the digital skills development of migrant community members. Using a mixed-methods design, we address the following research questions:

1. To what extent does exploring and creating multilingual digital cultural activities on the ENACT web app impact the digital skills of migrant community members?
2. Were there any differences between migrant and home community participants in terms of their digital skills gains during the co-production workshops?
3. How did migrant participants perceive the development of their digital skills while using the ENACT web app?

[2]The Communities, Languages, and Activities App (ENACT) project is co-funded by the European Commission, Erasmus Key Action 2 Strategic Partnerships for Higher Education, project number: 2019-1-UK01-KA203-061567. The European Commission's support for the production of the project outputs and publications does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use that may be made of the information contained therein.

[3]We recognise that people do not always associate languages and cultures in a uniform manner, and there is no one-to-one correspondence between language, culture, and nationality. Interculturality focuses on how individuals engage with each other and navigate cultural and linguistic differences that emerge or are perceived during interactions. This process of negotiating interculturality can occur not only between people from different nations but also among individuals from diverse groups, such as linguistic or religious communities, within the same country.

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The ENACT web app was pedagogically designed following task-based language teaching (TBLT) criteria (Ellis, 2003), and the theoretical framework for digital skills development and assessment was DigComp (Ferrari, 2013). Both are explained in Section 3.2.

2. Pedagogical and design aspects of the ENACT web app

In this section, we present TBLT as the pedagogical basis for learning and describe DigComp as the framework that informed web app design for development and assessment of digital skills.

2.1 Pedagogical basis of the ENACT web app: TBLT

In computer-assisted language learning, integrating solid pedagogical approaches is crucial for delivering high-quality educational experiences, as technology often replaces the tutor's role and defines what users can achieve (Hubbard, 2006; Smith & González-Lloret, 2021). TBLT is a highly effective method, focusing on real-life tasks with communicative goals that promote both language and cultural learning (Ellis, 2000; Nunan, 2004; Willis, 1996). TBLT typically includes three stages: pre-task to activate prior knowledge and set the context, the main task simulating real-life activities, and post-task to consolidate learning (Nunan, 2004; Willis, 1996). Supported by cognitive and social constructivist theories, TBLT is ideal for instructional design in digital environments (Li, 2017).

Many language learning apps, however, lack culturally relevant tasks (Bradley & Al-Sabbagh, 2022) and rely on mechanical drills (Nielson, 2011). While most TBLT research centres on classroom task design (González-Lloret & Ortega, 2014), applying its principles to software development can significantly enhance learning experiences. The ENACT web app, for instance, incorporates TBLT by engaging learners with cultural tasks rather than isolated linguistic exercises, encouraging holistic use of all four language skills and fostering collaboration. These goal-oriented tasks focus on creating cultural artefacts, such as cards or dances, providing learners with clear, tangible outcomes.

The ENACT web app follows a structured sequence that seamlessly integrates language and culture. In the pre-task phase, learners watch context videos and interact with images to learn new vocabulary, preparing for the main task, which involves completing a cultural activity while following on-screen instructions. The post-task phase encourages reflection, vocabulary review, and self-evaluation. Learners can also share their personal adaptations (re-enactments) of the activity, promoting intercultural exchange. This participatory approach reinforces that learning about culture is not just informational but experiential (Thorne, 2016), with the app shaping "particular morphologies of action together with humans" (Thorne, 2016: 189).

2.2 Digital skills framework informing design and assessment: DigComp

Digital literacy is defined as the "ability to adapt the affordances and constraints of [digital] tools to particular circumstances" (Jones & Hafner, 2012: 13). This does not only refer to "*technical* skills, but perhaps more importantly, an awareness of the social practices that surround the appropriate use of new technologies" (Dudeney & Hockly, 2016: 115). Dooly and O'Dowd (2012) suggest that as digital interactions blur the lines between proximity and reality, language learners must skilfully integrate their linguistic abilities with digital skills to collaborate and thrive in these evolving contexts. Effective digital co-creation, in addition to requiring technical competencies, also depends on digital literacies that empower individuals to critically evaluate the quality and relevance of digital resources, navigate diverse cultural and social contexts online, and collaborate effectively to contribute meaningfully to digital content and environments.

The European Commission's Digital Competence Framework for Citizens (DigComp) outlines essential digital skills for work, learning, and societal participation (Ferrari, 2013). First launched

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in 2013 and updated several times, with DigComp 2.2 the latest version (Vuorikari, Kluzer & Punie, 2022), it includes over 250 examples of skills related to emerging technologies. DigComp categorises digital competence into five areas – information and data literacy, communication and collaboration, digital content creation, safety, and problem solving – which are further divided into 21 competencies. App developers can use this framework to create learning experiences that enhance digital skills (Siddiq, Olofsson, Lindberg & Tomczyk, 2024).

The ENACT web app supports digital skill development through various interfaces. The LEARN interface allows users to browse and locate information, engage with interactive elements, such as pop-ups and audio buttons, and follow captions or subtitles, audio, video, and images to make meaning from multimodal and multilingual content. The CONNECT interface requires account creation (including completing an email authentication process), taking pictures or videos and uploading them on the platform. Given the web app is publicly available, it also requires an awareness of issues around netiquette and digital literacy, such as content appropriateness and anonymity – that is, whether participants would show their faces in the content, use generic accounts created by the project staff, and use a pseudonym or real name for the account that will be shown on the app. It also facilitates interaction through voting, commenting, and content sharing using common social networking techniques.

Technically, the app is built using the H5P engine (https://h5p.org/), an open-source tool that supports the authoring and embedding of HTML5 interactive media content. The development of the web app and the interface are detailed in (Kharrufa *et al.*, 2022). Using the CREATE interface, content creation follows a four-step process that involves uploading resources (Figure 1: context video, vocabulary review) and adding interactivity (Figure 2: vocabulary introduction, video explaining how to do the activity), as well as two optional steps to use a 360-video and a content review.

The CREATE interface requires digital content creation skills, including

- taking, managing, and editing images, videos, and sound using basic editing software (e.g. cropping, rotating, adding music, text, etc.)
- browsing the internet to identify publicly accessible videos and images to be reused, evaluating their appropriateness, copyright and licences (e.g. Creative Commons), and integrating or re-elaborating the content
- uploading the resources (sound, image, and video files) on the CREATE interface
- using the tools on the CREATE interface to produce interactive content like pop-ups, audio recordings, descriptions, captions, and matching exercises.

The DigComp 2.0 framework (Vuorikari, Punie, Carretero Gomez & Van den Brande, 2016) and its successor DigComp 2.1 (Carretero Gomez, Vuorikari & Punie, 2017) remain highly regarded for assessing digital competences. The framework's eight proficiency levels allow users to benchmark digital skills against standardised European competencies. Studies have employed DigComp to evaluate digital skills, such as Gil (2019), who studied its adaptation for various populations, including migrants. In Thailand, the International Organization for Migration (2023) used DigComp 2.0 to assess 456 migrant workers, identifying skill gaps and informing tailored training programmes to enhance digital inclusion and employability.

The ENACT Digital Competency System was modelled after the DigComp 2.1 framework. It retained only the relevant competencies, excluding safety and problem-solving areas, and removed three specific communication skills, resulting in nine skills across information and data literacy, communication and collaboration, and digital content creation. For example, the first item within "Competence area 1: Information and data literacy" was "1.1. Browsing, searching and filtering data, information and digital content", which included descriptors related to articulating information needs, searching for data, information and content in digital environments, accessing and navigating between them, as well as creating and updating personal search strategies.

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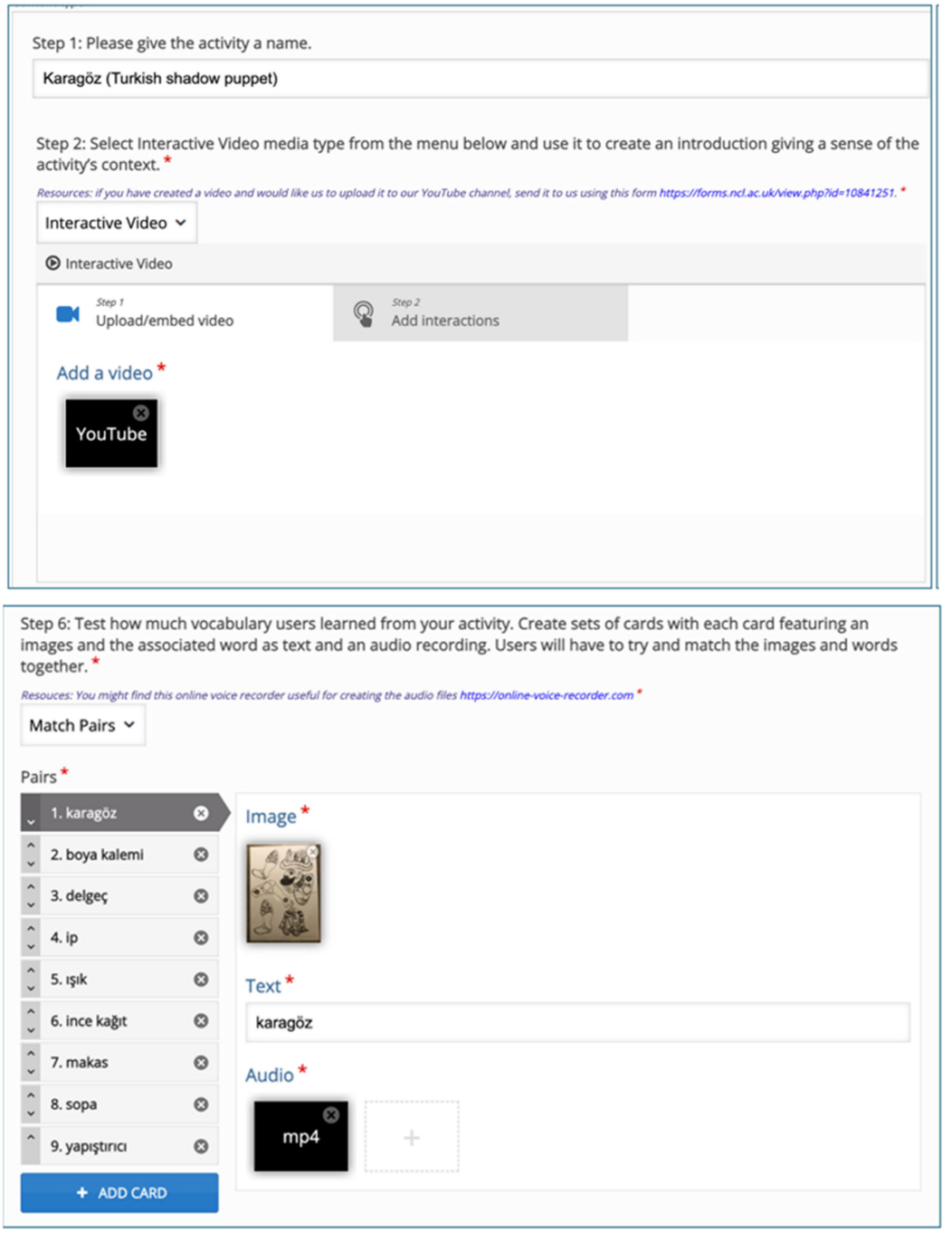


Figure 1. CREATE interface of the ENACT web app: Uploading resources during Step 1 (top), and Step 6 (bottom).

ENACT maintained only the first four proficiency levels, focusing on foundation and intermediate levels. The ENACT digital competency skills self-assessment (Table 1) (full version can be accessed at https://enacteuropa.com/sites/default/files/Enact_digital_skills_certification_system.pdf) was then turned into an online survey for easier data collection.

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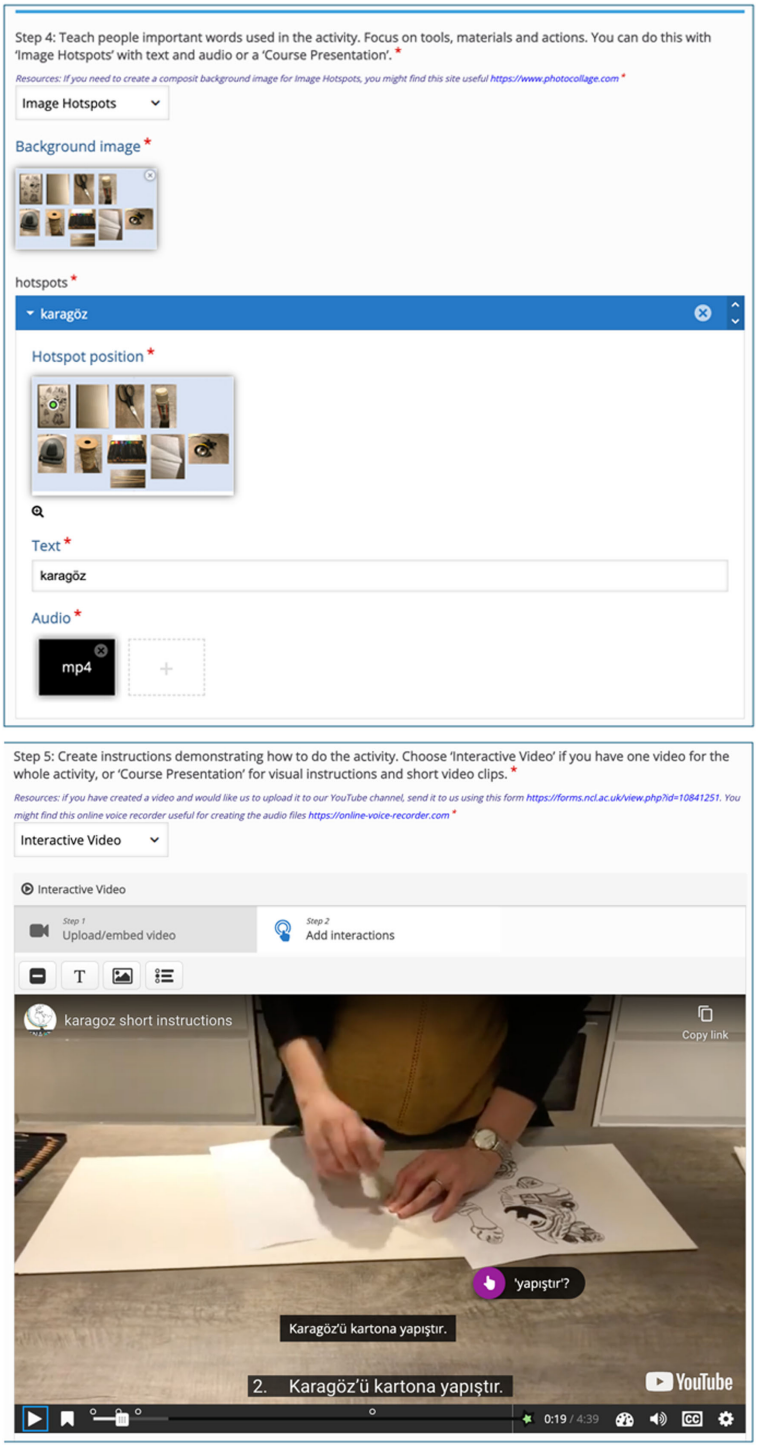


Figure 2. CREATE interface of the ENACT web app: Adding interactivity during Step 4 (top) and Step 5 (bottom).

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Table 1. Example of the ENACT Digital Competency System adapted from DigComp

	Foundation		Intermediate	
	1	2	3	4
Proficiency levels	At a basic level and with guidance, I can • **identify** my information needs • **find** data, information and content through a simple search in digital environments • **find** how to access these data, information and content and navigate between them • **identify simple** personal search strategies.	At a basic level and with autonomy and appropriate guidance where needed, I can • **identify** my information needs • **find** data, information and content through a **simple** search in digital environments • **find** how to access these data, information and content and navigate between them • **identify simple** personal search strategies.	On my own and solving straightforward problems, I can • **explain** my information needs • **perform well-defined and routine** searches to find data, information and content in digital environments • **explain** how to access them and navigate between them • **explain well-defined and routine** personal search strategies.	Independently, according to my own needs, and solving well-defined and non-routine problems, I can • **illustrate** information needs • **organise** the searches of data, information and content in digital environments • **describe** how to access to these data, information and content, and navigate between them • **organise** personal search strategies.
ENACT	At a basic level and **with guidance**, I can • identify on a device (computer or iPad) which applications/ programmes to use for specific digital needs (such as recording and editing videos) and access them • search for material (e.g. text, images, video, audio) I need for my task online and select suitable ones to use.	At a basic level and **with autonomy** and appropriate guidance where needed, I can • identify on a device (computer or iPad) which applications/ programmes to use for specific digital needs (such as recording and editing videos) and access them • search for material I need for my task online and select suitable ones to use.	**On my own and solving straightforward problems**, I can • explain to a friend how to find material for their tasks online and give tips to choose suitable ones • use keywords to find the exact material I need.	**Independently, according to my own needs, and solving well-defined and non-routine problems**, I can • illustrate to a friend how to find material for their tasks online and give tips to choose suitable ones • use keywords to find the exact material I need and describe this process to a friend.

Overall, DigComp is a comprehensive framework useful in app design to foster digital skills and assess user progress. Its structured approach and widespread application across Europe make it a reliable tool for addressing the digital literacy needs of diverse populations.

3. Methods

This study followed a mixed-methods approach, analysing migrant community members' self-assessment data from the ENACT Digital Competency System (Table 1) before and after co-production workshops, along with qualitative data from post-workshop interviews.

3.1 Participants

In the ENACT project, 46 migrants and 43 home community members participated in co-production workshops. This paper reports on 39 migrant and 39 home community members

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Table 2. Frequencies in the migrant and home participant groups by demographic factors

	Migrant		Home	
Demographic factors	*N*	%	*N*	%
Age				
10–15 years	1	2.6	1	2.6
16–24 years	12	30.8	17	43.6
25–40 years	18	46.2	15	38.5
40–59 years	7	17.9	3	7.7
60 years and above	1	2.6	3	7.7
Total	**39**	**100.0**	**39**	**100.0**
Education				
Primary	N/A		N/A	
Secondary	3	7.7	3	7.7
College/vocational	5	12.8	6	15.4
Undergrad	22	56.4	25	64.1
Post-grad and above	8	20.5	5	12.8
Missing	1	2.6	N/A	N/A
Total	**39**	**100**	**39**	**100.0**
Gender				
Female	25	64.1	30	76.9
Male	13	33.3	7	17.9
Missing	1	2.6	2	5.1
Total	**39**	**100**	**37**	**100**
Country				
Finland	3	7.7	5	12.8
Türkiye	8	20.5	9	23.1
Spain	12	30.8	12	30.8
United Kingdom	16	41.0	13	33.3
Total	**39**	**100**	**39**	**100**

who completed the pre- or post-workshop digital competency scale in Finland, Türkiye, Spain, and the UK (Table 2). Participants, aged 10 to 60+, came from diverse countries, including China, Colombia, Syria, and Azerbaijan, and spoke various languages such as Spanish, English, Italian, Turkish, and Arabic. Many were proficient in multiple languages. Sixty participants had or were pursuing undergraduate degrees, six held master's degrees, and one was pursuing a PhD. Migrants were recruited through institutions like charities and schools. In Spain and Türkiye, most were international students (first-generation migrant students). In Finland and the UK, there was greater variety: some were second-generation migrants (especially in the intergenerational pairs) and others were first-generation migrants with diversity regarding the number of years spent in the target country. Home community members were recruited through personal and institutional networks, and some were second-generation migrants who considered themselves part of the

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home community. Thus, the criterion for recruitment was not nationality but participants' self-categorisation. Participants received vouchers, refreshments, and travel reimbursements as needed.

The migrant and home community participant groups displayed similar percentage distributions across age, education, and gender, with female participants constituting about 70% of the participants. The migrant community members had a slightly higher age range between 25 and 40 years compared to the home community members, who were predominantly 16–24 years old. There was only one participant in each group who was in the 10–15-years age group (cf. European Commission: Joint Research Centre & Rodrigues, 2018). Neither home nor migrant community member groups were homogeneous, demonstrating diversity in the groups.

3.2 Context and procedures

Data were collected during co-production workshops organised for the EU-funded ENACT project (https://www.enacteuropa.com/) engaging home and migrant community participants in intercultural or intergenerational pairs. Each workshop lasted 10–12 hours and took place between May and December 2021.

The workshops included four components. First, participants completed assessment activities (Satar *et al.*, 2022), including the ENACT digital competency survey, questions and interviews about digital skills, linguistic and cultural awareness, and assessment for vocabulary learning. This study reports only on the digital competency survey and interviews. Second, participants explored interactive artefacts on the web app, such as Shadow Puppets (Turkish) and Carving a Hallowe'en Pumpkin (English), choosing activities from the LEARN menu. Third, participants physically produced one activity they explored, such as Rosa di Sant Jordi (Catalan) in the UK, and shared their creations on the CONNECT interface, with comments on what they had learned about the language and culture (Figure 3).

The final step of the workshops involved participants co-creating their own cultural activities on the app, like Mardi Gras – Let's Make a Mask! and Hoye Hoye (Eritrean cultural celebration). Facilitators supported digital skills (e.g. video production and editing) and task-based video creation, covering storyboarding, speech articulation and speed, camera positioning, and body language, ensuring high quality of materials. Participants chose the appropriate language for their final digital artefact, while workshops were conducted in the host language to optimise linguistic benefits for migrant community members.

Workshop formats varied by location, based on local needs and COVID-19 restrictions. In Finland, Spain, and the UK, most sessions were in person, with the final session online. In Türkiye, all workshops were conducted online (Figure 4).

Following the co-production sessions, participants completed the ENACT digital competency survey again, along with self-evaluation tools for language and cultural awareness. A vocabulary delayed post-test was also conducted (reported elsewhere). Participants received a certificate and a statement of the digital skills they had developed.

Ethics and informed consent were crucial in our workshops, as participants included vulnerable groups such as migrants, refugees, and asylum seekers. Each HE institution in the EU countries ensured compliance with their ethical procedures, including risk assessment and data management. The lead institution provided initial participant information sheets, consent forms, and a risk assessment, which were adapted by each partner country and approved by their ethics committees. Participation was voluntary, and the data in this article comes from participants who consented to the use of their anonymised responses in research publications.

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Figure 3. Example participant comment on the activity they produced.

3.3 Data collection and analysis methods

Quantitative data were collected using the 9-item ENACT digital competency self-assessment questionnaire (Section 2.2), with responses on a 4-point scale from basic "a" to proficient "d". These were numerically coded into a maximum total score of 36, with 12 points per subcomponent. The questionnaire had high validity since it was adapted from the EU framework DigComp, which has been extensively tested. Internal reliability was measured using Cronbach's alpha (data from 78 participants), showing strong reliability for both pre-workshop ($\alpha = .939$) and post-workshop ($\alpha = .950$) responses, exceeding the .7 threshold.

Demographic background factors were coded as categorical variables for age, education, gender, and country. Due to missing responses, not all participants' pre- and post-workshop survey scores could be matched. A total of 78 participants responded to the survey, with 57 ($N_{\text{migrant}} = 30$, $N_{\text{home}} = 27$) providing both pre- and post-workshop responses. Normality and homogeneity were tested using Kolmogorov–Smirnov and Levene's tests. Although normality was violated in migrant post-workshop responses, the data were retained as skewness and kurtosis values fell within the acceptable range of $-/+2$, with no outliers detected.

Participants were guided through semi-structured interview questions to explore their experiences using digital technologies in daily life, for language learning, their views on the ENACT web app, and the impact on their digital skills. This narrative-type data elicitation enables researchers to address the complexities and subtleties of human experiences (Mertova & Webster, 2019). Example questions were, What is your experience using social media like Facebook and YouTube? Have you tried learning another language or culture independently? What is your motivation for using the ENACT app? What aspects of the app are most useful or challenging, and what would you change?

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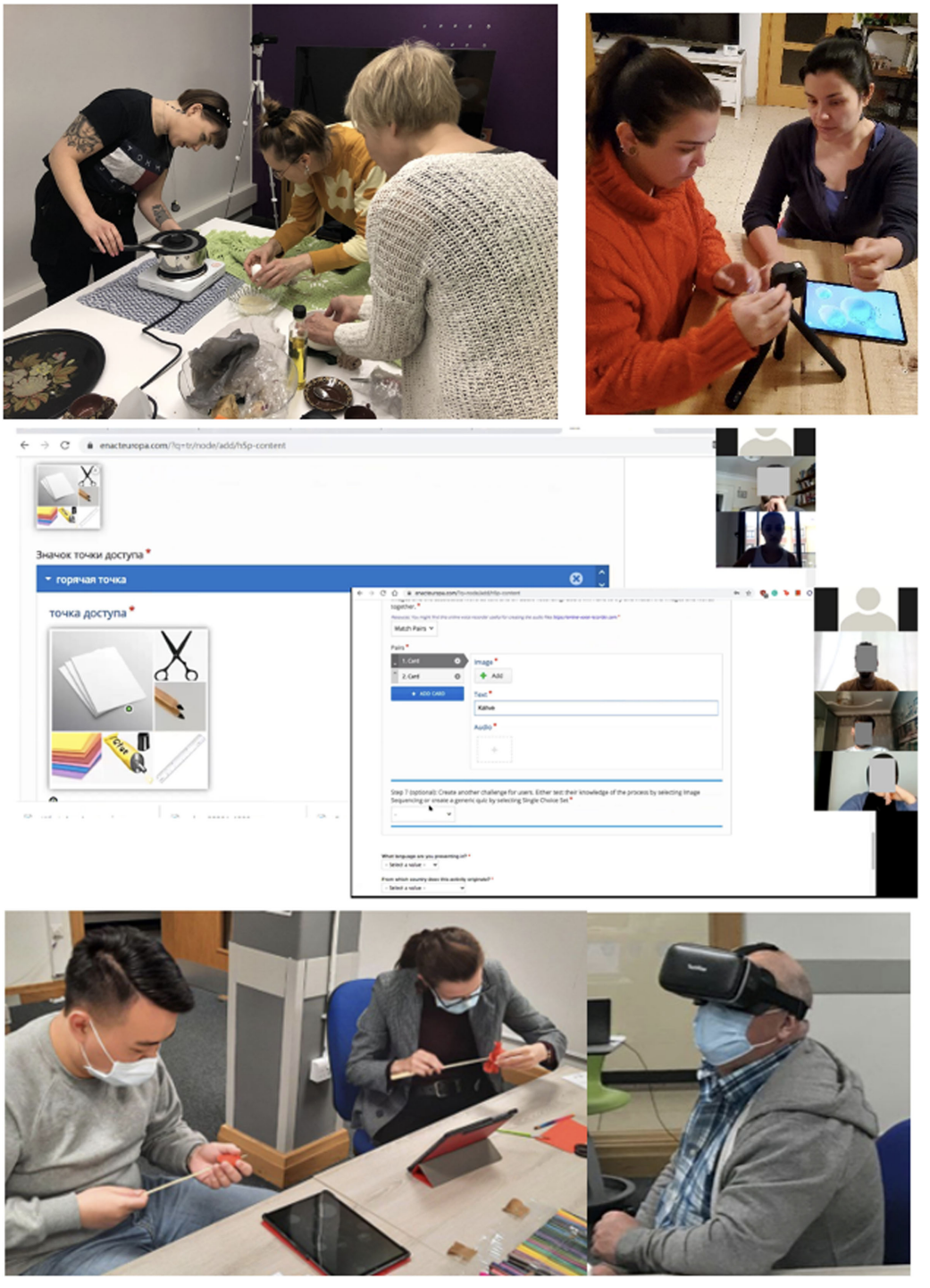


Figure 4. Co-production workshops in Finland, Spain, Türkiye, and the UK.

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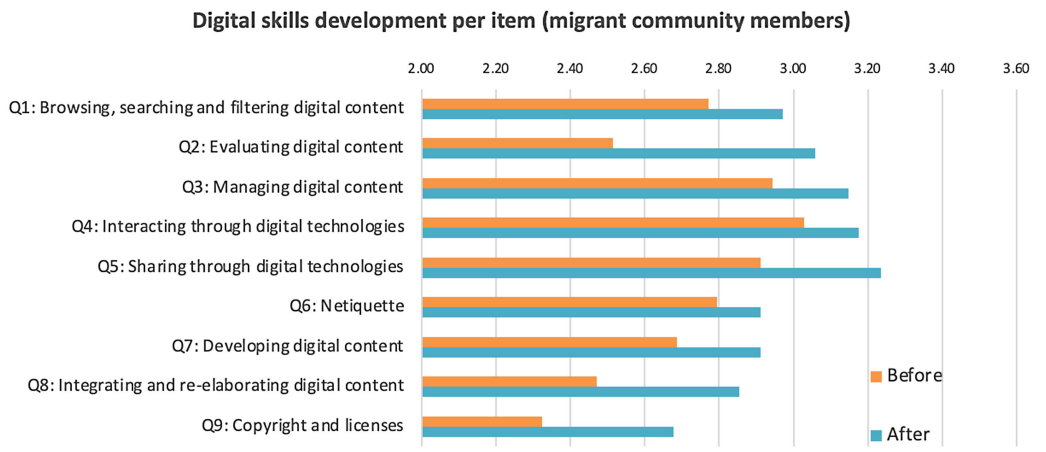


Figure 5. Migrant community members' digital skill development per skill.

After compiling interview data from all participants, data were transcribed and analysed using deductive content analysis (Kyngäs & Kaakinen, 2020) based on the ENACT digital competency self-assessment system. Two researchers coded the data, reviewed discrepancies, and finalised the analysis by consensus. Translations of example quotes were provided for interviews conducted in languages other than English.

4. Findings

4.1 Migrant community members' digital skills gains

To address RQ1, we first present the digital skills outcomes for migrant participants. The three digital competency areas and related skills from the survey were analysed for migrants, as shown in Figure 5 and Table 3. Overall scores were calculated for the entire pre- and post-workshop data, with each item rated from 1 to 4. Each competency area had three items, with a maximum possible score of 12.

As shown in Figure 5, migrant community members' digital competency self-assessment scores were higher for each skill after their participation in project workshops. Highest gains were observed for the skills of evaluating digital content (Q2), integrating and re-elaborating digital content (Q8), copyright and licences (Q9), and sharing through digital technologies (Q5). Table 3 also shows that self-assessment mean scores of migrant community members increased for all digital competency areas, with the highest increase in digital content creation (7.47 to 8.44), followed by information and data literacy (8.23 to 9.18), and then communication and collaboration (8.74 to 9.32). Inferential statistics results comparing total pre- and post-digital competency self-assessment scores for migrant and host community members are presented in the next section.

4.2 Differences between migrant and home community members' digital skills gains

In response to RQ2, we first explored the differences between the migrant and home community members' total self-assessment scores and statistically compared them as independent groups on their overall pre- and post-workshop responses. Statistical analyses were calculated on the pre- and post-matched data for participants who had both pre- and post-workshop responses.

Figure 6 and Table 4 show that both migrant and home community members' self-assessment of their digital skills increased after participating in the ENACT project co-production workshops

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Table 3. Migrant participants' pre- and post-workshop responses by digital competency areas

Digital competency areas	Pre-workshop	Post-workshop	Difference pre to post
Information and data literacy	8.23 ($N = 35$)	9.18 ($N = 34$)	0.8 ($N = 30$)
Communication and collaboration	8.74 ($N = 34$)	9.32 ($N = 34$)	0.55 ($N = 29$)
Digital content creation	7.47 ($N = 34$)	8.44 ($N = 34$)	1.103 ($N = 29$)

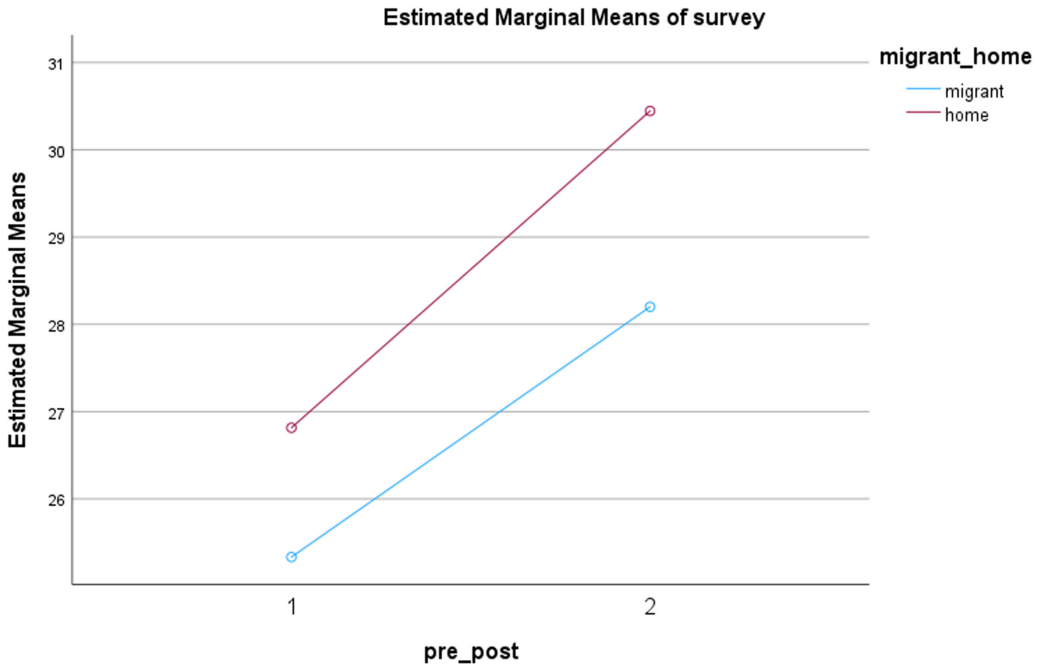


Figure 6. Estimated marginal pre- and post-workshop digital competency self-assessment mean scores of migrant and home community participants.

(from 25.33 to 28.20 and from 26.81 to 30.44, respectively). Migrant community members' pre- and post-workshop scores were slightly lower than those of home community members.

To compare the two groups' scores using inferential statistics, the critical p value was set at 0.025, implementing a Bonferroni adjustment for multiple comparisons. In the pre-workshop responses, an independent samples t-test indicated that the migrant ($N = 35$, $M = 24.06$, $SD = 8.39$) and home ($N = 33$, $M = 26.03$, $SD = 6.67$) participants did not significantly differ in their total digital competency survey responses, $t(66) = -1.07$, $p > .025$. In the post-workshop responses, a separate independent samples t-test with a correction for equality of variances indicated that the home participants ($N = 33$, $M = 30.55$, $SD = 4.49$) had only marginally significantly higher survey responses compared to the migrant participants with a medium to large effect size ($N = 34$, $M = 26.94$, $SD = 7.97$), $t(65) = -2.29$, $p = 0.026$, Cohen's $d = .558$.

To examine the effects of the background and the workshop experience, a 2 x 2 mixed analysis of variance (ANOVA) with the within-subjects workshop effect (i.e. pre- and post-workshop data) and between-groups background effect (i.e. migrant and home group) was conducted. As indicated in Table 5, the results indicated that only the main effect of workshop experience was

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Table 4. Descriptive statistics for the matched pre- and post-workshop responses

	N	*M*	*SD*	Min	Max	Skew.	Kurt.
Pre-workshop							
Migrant	30	25.33	8.04	9	36	−.814	−.247
Home	27	26.81	6.77	11	36	−.592	−.016
Post-workshop							
Migrant	30	28.20	7.2	9	36	−.910	.169
Home	27	30.44	4.7	19	36	−.708	−.010

significant, while the interaction effect and the main effect of background were not statistically significant.

These results indicate that both the migrant and home community members had significantly higher total scores of digital competence after the workshops compared to those before the workshops. The lack of significance in the interaction effect also indicates that there were no statistically significant differences in the pre- or post-workshop scores between the migrant and home community members.

In the next section, we turn to RQ3 to investigate participants' perspectives on the development of their digital skills during their engagement with and creation of cultural activities in multiple languages on the ENACT web app.

4.3 Migrants' perspectives towards development of their digital skills

In this section, we present the key points from the interviews (Figure 7), along with examples that illustrate the findings in accordance with the different competence areas established in the digital skills self-assessment described in Section 2.2.

For **Competence area 1: Information and data literacy**, the participants were asked questions related to *browsing, searching, and filtering data*. They were also asked whether they knew how to *articulate* their information needs, search for data, information and content in digital environments, and if they knew how to access and navigate between different environments according to its orientation. Overall, the participants demonstrated *confidence* in their ability to browse, search, and filter data and digital content, with varying levels of proficiency reflected in their self-assessment using the digital skills self-assessment tool:

> I know how to search for data of course; the problem comes when you need to see if it's real [. . .] I can check if it comes from a news article like, La Vanguardia, but sometimes if it comes from a Blog, then I doubt it [. . .] all to say, I'm good but I don't know how good I am.

In contrast, in the self-assessment results, a participant from the UK indicated that she felt more confident at the beginning of the process, and by the end, after learning and experiencing the web app and the associated digital tools, she had become more *self-aware* of her digital skills and reduced her confidence level in several aspects. These included evaluating data and digital content, and the three statements on digital content creation. When filling in the digital skills self-assessment tool, the participants were generally hesitant to score themselves higher than intermediate level, although participants who had specific digital skills backgrounds did mark themselves higher:

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Table 5. Workshop and background effects on digital competency responses

Source of variation	Sum of squares	*df*	Mean square	*F*	Partial η^2	Sig.
Between-subjects						
Background (migrant or home)	98.64	1	98.639	1.15	.021	.287
Error	4684.33	55	85.17			
Within-subjects						
Workshop (pre or post)	299.86	1	299.86	35.55	.393	<.001
Workshop*Background	4.14	1	4.14	.49	.009	.487
Error	463.88	55	8.43			

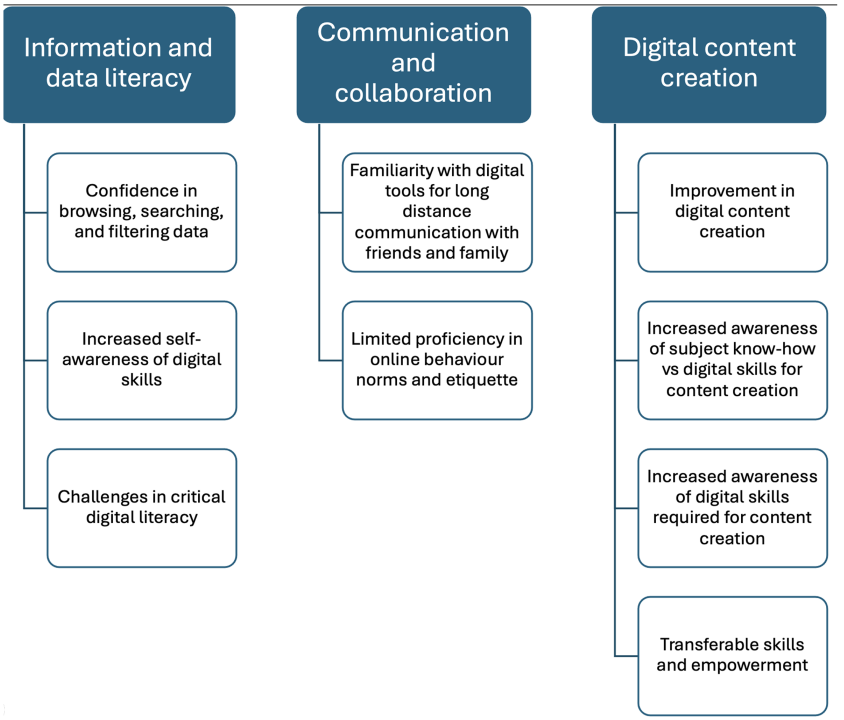


Figure 7. Migrants' perspectives towards development of their digital skills.

> I'm not as proficient as my partner. I know I should check more where the information comes from [. . .] I'm going to choose the intermediate level stage 3, just in case.
>
> I know how to do that, I'm an engineer, I have contact with data always and I know I'm proficient at telling others how to search and organise data [. . .] I'm sure I'm independent.

As can be seen in these examples, despite feeling confident in initial browsing and searching skills, participants expressed challenges in *critical digital literacy* – that is, evaluating the reliability and credibility of some data and digital content, particularly when sourced from non-traditional platforms like blogs. This perhaps speaks to the growing need for being able to discern and

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authenticate sources of digital information. We can also observe that, in some cases, participant confidence levels fluctuated throughout the workshops following exposure to the empirical workshop of content creation, as they seem to become more aware of challenges in digital use in areas they do not habitually engage in.

For **Competence area 2: Communication and collaboration**, participants assessed their ability to interact with digital technologies, as well as how they shared data, information and digital content with others using the appropriate digital technologies. In this area, the participants' differed little between the first and last workshop session. In general, the participants indicated a strong *familiarity* and comfort with technology use, and highlighted the ease with which they share data and communicate with friends and family, especially across long distances:

> Sharing data and communicating with friends and family is easy for me; they live at the other side of the world

In this participant's case, he felt that he had not improved in this digital skill following the workshop, as it was something he was already proficient at. This was the same for several other participants, as expressed by another participant as follows:

> I know how to identify the appropriate digital platform to interact with my friends or colleagues; I don't think my answer has changed from the first workshop to this one [. . .] I feel confident

Participants did assess themselves lower as regards their awareness of *behavioural norms and etiquette* while using digital technologies and interacting online. For example, one participant initially felt uncertain about her knowledge in this area, although she recognised the importance of adapting communication strategies for diverse audiences:

> Understand the concept of digital etiquette and discuss appropriate behaviour . . . I think I know, we are not going use bad language online, but discuss communication strategies to adapt material for language learners from different cultures, is something I'm not sure about, I don't think I know how.

This uncertainty seemed to have arisen when faced with the specific case of knowing how to adapt teaching materials for language and culture for a global digital audience:

> I'm not expecting to be really good at it; I'm sure I will learn . . . [during the workshop].

By the end of the sessions, her answers indicated that she had experienced growth in her understanding of digital etiquette and communication strategies by participating in the workshop sessions, although she also indicated that she felt the need to improve further:

> I'm not choosing the stage 4 in this component; I think I'm not at the foundation level as before [. . .] I think the intermediate level is ok for me now.

In the communication and collaboration competence area, participants expressed higher post-workshop evaluations for sharing data and content, reflecting their comfort with technology from regular use. However, they expressed lower awareness of digital etiquette and adapting communication for diverse audiences. Some participants reported improved understanding of digital etiquette through the workshops but acknowledged the need for further improvement.

For **Competence area 3: Digital content creation**, participants were asked about content development in different formats, such as modifying, cultivating, improving, and integrating

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information into an existing body of knowledge. This competence also included understanding how copyright and licences apply to data, digital information and content.

Interview data indicated overall *improvement in digital content creation* after engaging with the ENACT web app. One participant said, "I've learned many things", showcasing the skills needed for creating, recording and uploading user instructions for the ENACT task, although she lamented not learning to edit the video that accompanied the task. (This pair used an existing video from YouTube.)

The creation of learning tasks for language and culture was highlighted as being especially challenging for participants without any background in teaching. The experience inspired them to reflect on the roles of learners and designers, indicating a broader impact beyond skill development alone. This underscores the *relationship between subject know-how and technological skills* when modifying, cultivating, improving, or integrating information into new or already existent digital content:

> I thought I was good with technology, but I realised I just knew the basics. [. . .] Now I'm familiar with different platforms and apps that can help me create online content, even for my social media. [. . .] I thank you guys for the opportunity to be part of this project; I had fun and I learnt. What else can I ask for?

Several of the participants initially considered themselves proficient in technology basics but then *realised they had room for growth*. Engaging with the web app helped them transition from foundational to intermediate levels in creating and editing digital content, such as videos, with guidance and support from facilitators and host community members:

> I know how to interact with the internet, find information and all of that, post something on Instagram, but I have never created a video, or had a tablet to try apps to do that. [. . .] That's something new for me.

This same participant changed his initial self-assessment from foundation level to intermediate after creating materials for the ENACT app while underscoring how he discovered the complexity of some of the digital tasks while engaging in the materials development:

> Cropping a video was easy, but then adding the subtitles at the exact point I needed them was more complex. [. . .] I didn't know creating a video would take a such a lot of time.

Participants found the step-by-step guidance and support provided during the workshops instrumental in acquiring new digital skills, such as adding transcriptions to videos and merging videos using online tools. This hands-on experience, combined with accessible instructions, empowered participants to develop new abilities and expand their digital knowledge as non-experts:

> This website to record the voice it's the easiest, I was thinking we were going to use a complex one, don't ask me which one! I just thought it was real complex [. . .] I had another idea in my head, things seem easier when you have guidance.

One participant who had initially assessed her digital skills at foundation level when it came to editing videos and adding transcriptions to them not only gained these digital skills during her engagement with the ENACT web app but also emphasised that these new-found competences were *transferable to other digital contexts* in her daily life:

> This session has been very eye opening. I can even use this at Uni, for my own presentations.

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Apart from learning about language and culture, the participants felt they had broadened their perspectives on digital content creation. This hands-on experience, combined with accessible instructions, *empowered participants* to develop new abilities and expand their digital knowledge:

> Even [if] we are not the expert of computer, we can still create interactive websites which make us a sense of achievement. I am so glad that I have an opportunity for joining this activity. Its experiences inspire me to think of the roles of learners and designers. Thank you :=).

Interview data show significant improvement in digital content creation skills, while recognising room for growth. Responses underscored the complexity of digital content creation, highlighting the connection between subject know-how and technological skills. These results also demonstrate how collaborative content creation helps both migrant and home community members learn from and with each other.

5. Discussion

This study explored migrants' digital skills development while learning language through culture and co-creating their own cultural activities in their own languages using a web app developed by an EU-funded project promoting social cohesion and linguistic and cultural gains. Migrant and home community members participated in project workshops and self-assessed their digital skills before and after, as measured via the ENACT digital competency survey and interviews.

Previous research has shown the role of digital technologies in migrants' language learning (Bradley *et al*., 2023; Eilola & Lilja, 2021; Guichon, 2019; Hashemi *et al*., 2017). Quantitative data in this study demonstrated significant improvement in both migrant and home community members' digital skills using an app designed for learning language through culture. Migrants showed the most improvement in digital content creation, especially in evaluating, integrating, and re-elaborating digital content, as well as understanding copyright and licences. The structured content creation process following the TBLT pedagogy and user-friendly H5P interface likely contributed to these gains (Kharrufa *et al*., 2022). The ability to reuse existing content (e.g. videos and images) and interaction with the human facilitators have also been instrumental. Future steps include incorporating AI to offer facilitation to all users. Regarding the skills for interacting and sharing through digital technologies and netiquette, creating a community on a web platform is a challenge, which could be enhanced by integrating authentic content creation tools like the ENACT web app with migrants' habitual social media platforms.

Migrant students typically perform worse in educational outcomes compared to home students and start using digital technologies later, but by age 15, they often catch up or surpass home students in intensive use of digital tools for education (European Commission: Joint Research Centre & Rodrigues, 2018). In this study, only one migrant participant was aged 10–15, likely explaining the lack of significant differences in pre- and post-workshop scores between migrant and home community members. Though migrant scores were slightly lower, both groups showed significant improvement, reinforcing a strength-based approach (Tour *et al*., 2021) that leverages digital skills to close achievement gaps (e.g. by enhancing their language skills) (European Commission: Joint Research Centre & Rodrigues, 2018).

Addressing this perspective requires a shift towards recognising migrants as individuals with agency and strengths who bring rich social, linguistic, and cultural resources (Tran, 2015). Inclusive environments, such as the ENACT workshops – which emphasise equality, mutuality, curiosity, and solidarity – enable both migrants and home community members to learn *with* and *from* each other, and therefore can help us tackle issues of community isolation and integration. Migrants are not a homogenous group, and neither are home community members. We need to target both migrant and home community members in supporting their digital skills development

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for successful integration and digital inclusion policies (Ahmad Ali *et al.*, 2022; Sancho-Pascual, 2020).

Qualitative analyses showed participants were confident in browsing and searching but became more aware of the challenges in evaluating the reliability and credibility of digital content they frequently used. This highlights the need for digital and mobile applications that support migrants' language learning to also incorporate critical digital literacy skills (Jones & Hafner, 2012; Satar, Hauck & Bilki, 2023).

In the second competence area, communication and collaboration, there is a need to better support awareness of digital etiquette and norms when creating content and interacting with diverse online audiences. Although the internet offers multilingual and multicultural opportunities for "contributing, creating, [and] curating" (Godwin-Jones, 2015: 8), authentic social interactions with target language communities are key to motivating migrants to use digital technologies in their learning (Bradley & Al-Sabbagh, 2022).

Finally, interview data revealed that participants felt they gained digital skills that were transferable to other aspects of their daily lives. Participants highlighted the ways in which the web app scaffolded digital content creation, and how its design inspired them to reflect on their roles as designers, using their linguistic and cultural knowledge alongside technological skills. This hands-on experience, combined with accessible instructions, empowered non-expert users to expand their digital abilities (e.g. digital storytelling; Sawhney, 2009). The web app design, aligned with migrants' needs, supported this growth and responded to Kukulska-Hulme's (2019) call for innovative tools co-created by migrants.

6. Conclusion

In this article, we demonstrated the need to focus on relevant digital competencies required to engage with technologies for language and culture learning in creative and agentive ways. While technology can enhance language learning and support societal participation, mere exposure does not guarantee effective use, and not all learners fully utilise its potential (Tammelin-Laine *et al.*, 2020). The ENACT project supported participants to gain new digital skills with potential benefits that include provision of networking and employment opportunities. At the same time, it played a key role in providing "social bridges" between the host and "new" communities by bringing individuals from migrant and host communities together to co-create digital cultural activities.

There were a number of limitations. First, data were not collected from the migrant community members in relation to the number of years spent in the target country, which could be an important indicator for their digital skills levels. Second, the home and migrant community groups were demographically diverse and not homogenous; therefore, we cannot make claims regarding the impact of participants' background on their digital skills levels. The research questions are thus in line with these limitations and focus on a comparison of digital skills development as a result of participants' engagement with the project workshops.

Future language learning applications (Kukulska-Hulme, 2019) can adopt similar inclusive pedagogies (Tran, 2015), allowing migrants not only to learn *from* home community members but also to co-create and share content to learn *with* each other in a two-way exchange of knowledge, skills, and ideas. Further research exploring digital, cultural, and linguistic development through collaboration among diverse communities can deepen our understanding of the synergies between these skills and how they can be developed to empower migrant populations. We conclude with a quote from a workshop participant highlighting the impact of this approach:

> It has a direct link with me as an immigrant, telling about yourself, introducing yourself to the others. Before the activity, I was thinking how do I adapt to the community and integrate to the local community. Now after these sessions, I don't have only to learn the local

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community's culture and language but I can also introduce my language and culture to the local community. (Refugee, co-production workshop participant)

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