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EDITORIAL

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Media Literacy in a Digital Age: Taking Stock and Empowering Action

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Abstract

This thematic issue presents 12 articles that explore the transformative potential of media literacy, digital skills, and ICT interventions in diverse contexts and populations, ranging from adolescents and youth with disabilities to university staff and vocational educators. It provides a comprehensive overview of research, including systematic and scoping reviews, empirical studies, and innovative measurement frameworks, highlighting both the opportunities and challenges in fostering media literacy and digital skills. The studies examine positive outcomes, barriers, and enablers of intervention programs, emphasizing the importance of tailoring approaches to specific contexts, addressing systemic inequities, and fostering interdisciplinary and international collaboration. Together, all contributing authors underscore the critical role of media literacy and digital skills in promoting empowerment, equity, and resilience in navigating the complexities of today's digital age.

Keywords

data literacy; digital literacy; digital skills; ICT interventions; media literacy; news literacy

1. Media Literacy, Digital Skills, and Digital Literacy: Two Review Studies

D'Haenens et al. (2025) systematically review 119 studies on media literacy and digital skills interventions, revealing mixed outcomes and emphasizing the need for tailored, evidence-based approaches. While frequently examined outcomes include media literacy, digital skills, psychological well-being, and education, only a fraction of interventions show significant positive effects, especially for older age groups. Children benefit most from these programs, with stronger impacts on educational outcomes, likely due to cognitive

development and intervention design. However, the study highlights gaps in areas like civic engagement and socio-cultural impacts, advocating for broader outcome measures to capture the multifaceted effects of media literacy and digital skills programs. The authors call for long-term studies, exploration of mediators and moderators, and interdisciplinary collaboration to address challenges in the digital age. These recommendations aim to refine intervention strategies and expand their impact across diverse populations.

In their scoping review, Vermeire et al. (2025) highlight data literacy as an evolving skill essential for navigating a datafied society. Their review traces its expansion from technical and statistical skills to a broader framework encompassing critical thinking, algorithmic awareness, and ethical engagement, positioning it as vital for informed citizenship and equity. Educational efforts increasingly integrate societal implications, though gaps remain in addressing vulnerable communities and ethical challenges in AI. The review calls for adaptable, socially aware approaches to ensure data literacy empowers individuals across diverse contexts and demographics. Overall, data literacy is framed as a dynamic and inclusive competency, crucial for responsibly engaging with a data-driven world.

2. Bridging Social Contexts

Tercova and Smahel (2025) explore the complex role of digital skills in adolescents' exposure to harmful online content, emphasizing that digital skills alone do not guarantee protection. Higher technical skills can increase unintentional exposure, while knowledge skills may fail to mitigate risks without active application. This highlights a bidirectional relationship where exposure raises awareness but also vulnerability. Family support is protective against intentional exposure, while peer influence may encourage riskier behaviors. Personality traits, such as sensation-seeking, and low life satisfaction also contribute to greater exposure, with risky online behaviors potentially reinforcing diminished well-being. The study advocates for comprehensive digital literacy programs that combine technical skills with resilience-building strategies and responsible online behavior. The authors call for further research into protective mechanisms, parental mediation, and targeted interventions to help adolescents navigate online risks safely.

Addressing gaps in culture, training, and resources, Koch and Fehlmann (2025) explore the factors shaping digital literacy and performance in academic settings, identifying six key dimensions: digital practice, attitude, knowledge and skills, culture, framework conditions, and service and empowerment. Their study highlights that while digital tools are widely used, engagement often remains basic, hindered by technical challenges, data security concerns, and a lack of tailored training. A supportive digital culture and institutional resources are essential for fostering innovation and reducing barriers. Customized training, accessible support, and mindfulness practices were identified as effective strategies to enhance digital performance and mitigate stress. The study emphasizes the need for institutional commitment to creating environments that encourage experimentation and align digital tools with academic needs. The authors introduce a self-assessment tool to identify gaps and improve digital engagement across teaching, research, and communication.

Šušterič et al. (2025) investigate the development of media literacy and digital skills among youth, emphasizing the interplay of family, school, and peer networks. Families provide the foundation for media guidance, particularly in socio-economically advantaged households where parental competence is higher. Schools, however, focus on basic technical skills and internet safety, missing opportunities to promote advanced digital competences and bridge the digital divide. Peer networks play a significant role, offering

spaces for social and digital capital development. Young people leverage media to enhance relationships, access cultural resources, and engage with online communities. However, the quality of shared information and critical evaluation within these networks remains a concern. The study highlights the need for future research on the intersection of media literacy with social positions and evolving media practices, aiming to equip young people for critical engagement in complex digital environments.

3. Critical Media Literacy: Empowering Journalists and the Public for Ethical Engagement

Emphasizing a shift from technical skills to fostering critical thinking, moral awareness, and intrinsic motivation, Balčytienė (2025) advocates for media literacy interventions that address deeper socio-psychological and ethical dimensions, enabling individuals to engage thoughtfully with media and navigate manipulation in complex digital environments. Central to the study is the role of journalists as both practitioners and educators in media literacy. Recognizing the interplay between technology, individual agency, and community dynamics, the study calls for innovative pedagogical strategies to enhance ethical decision-making and professional responsibility. By adopting this human-centered approach, journalism education can equip professionals to model critical engagement and uphold democratic values. This holistic approach positions media literacy as a cornerstone for fostering societal resilience, combating misinformation, and promoting a culture of informed and ethical media practices.

Tang et al. (2025) explore the potential and limitations of a short news literacy video in combating misinformation. While the intervention increased participants' appreciation of news literacy's societal importance, it did not enhance their self-perceived ability to apply these skills. A key finding was the unintended consequence of heightened skepticism toward all media content, including accurate information. This highlights the risk of fostering cynicism, which can lead to disengagement from credible sources and weaken democratic discourse. To address this, the study advocates for balanced interventions that encourage critical thinking about dubious content while promoting trust in reliable information through practical tips and efficacy-building strategies. The authors emphasize the importance of tailoring news literacy interventions to vulnerable groups and diverse contexts, with future studies needed to assess their long-term impact and adaptability. The findings demonstrate the potential of news literacy videos to influence media engagement, reinforcing the need for well-designed media literacy strategies that foster an informed and resilient public.

4. Bridging Research and Practice

Batista et al. (2025) examine innovative approaches to fostering media literacy and digital skills among young people, focusing on bridging the gap between research and educational practice. A key contribution is the ySKILLS Education Toolkit, a research-based resource designed to enhance adolescents' digital literacy through adaptable, multidimensional activities that address both risks and opportunities in the digital space. Teachers and students alike praised the toolkit for its practicality, engagement, and versatility across disciplines, emphasizing its potential for meaningful integration into diverse educational contexts. The study highlights areas for improvement, including clarifying instructions, adopting a more experimental activity format, and incorporating content on emerging technologies like AI. Regular updates and feedback mechanisms are recommended to enhance adaptability and measure impact. Additionally, the study identifies a disconnect between research and practice, with teachers often viewing themselves as

implementers rather than active participants in research. Strengthening researcher-educator collaboration and fostering reflective practices could bridge this gap.

Dunan et al. (2025) underscore the transformative role of ICT in enhancing empowerment and inclusion for people with disabilities, focusing on skill development programs. Grounded in empowerment theory, these programs bolster autonomy, economic engagement, and social integration while addressing systemic challenges in applying ICT skills. Participation fosters self-confidence, digital literacy, and independence, aligning with global evidence of ICT's potential to reduce social isolation and improve access to education and employment. However, barriers such as limited access to assistive technologies, disparities in ICT proficiency, and a lack of adaptive materials limit the effectiveness of these programs. The study advocates for tailored, modular training platforms, inclusive infrastructure, and increased funding through public–private partnerships. Continuous evaluation and adaptive learning technologies are highlighted as critical for enhancing program impact. This research offers a holistic approach integrating technology, policies, and infrastructure to empower people with disabilities and promote equitable participation in social and economic spheres.

Gross and Balaban (2025) explore the impact of educational interventions on media literacy and disinformation. The authors highlight the program's ability to improve social media literacy and reduce conspiracy beliefs, though it did not significantly affect participants' intentions to share fake news, reflecting the complexities of combating disinformation. A key insight is the role of intellectual humility as a moderating factor. While individuals with low to moderate intellectual humility gained algorithmic awareness, those with high intellectual humility reported a decline in perceived social media literacy, emphasizing the need for tailored approaches to address individual differences. The study underscores the potential of educational programs to foster critical thinking and algorithmic awareness, but it also warns against overconfidence stemming from increased perceived literacy without corresponding skills. The findings call for media literacy initiatives that integrate cognitive and motivational dimensions, account for individual traits, and adopt multi-faceted strategies to address the challenges of the digital information environment.

Hernández-Serrano et al. (2025) introduce the FLEXI-COMP framework for integrating digital and social skills in vocational education and training, addressing the sector's need for adaptable, contextualized approaches. Piloted across five countries, FLEXI-COMP emphasizes creativity, collaboration, and professional preparation alongside digital competence to support diverse learner needs. The study highlights barriers such as workload pressures and limited access to tools, advocating for participatory, flexible training programs that blend self-assessment with practical tasks. Policy recommendations include needs-based skill assessments and project-based learning to refine vocational education and training frameworks.

By integrating digital and social competences, FLEXI-COMP aims to prepare educators and learners for the challenges of rapidly evolving educational and labor markets.

5. Innovating Measurement: A Performance-Based Framework for Assessing Children's Digital Skills

Van Laar et al. (2025) present a performance-based framework for assessing children's digital skills, focusing on information navigation, communication, and content creation. This cross-national study emphasizes

authenticity by using open internet tasks aligned with relatable themes like climate change and Covid-19, ensuring relevance across diverse cultural and educational contexts. The research highlights innovations such as standardized coding schemes and iterative design refinement, addressing cultural nuances and participant engagement. Challenges, including personalization in search results and platform variations, were mitigated by focusing on transferable skills and providing explicit instructions. Despite its strengths, the study acknowledges the labor-intensive nature of performance testing and its limitations in capturing all aspects of digital competence. It advocates for mixed-method approaches combining qualitative and quantitative assessments to ensure comprehensive and scalable measurement. This framework advances the direct assessment of digital skills, moving beyond self-assessments, and offers valuable tools for educators and policymakers to support media literacy education and policy in cross-national contexts.

The contributions in this thematic issue underscore a shared imperative: fostering nuanced, context-aware, and evidence-based approaches to media literacy and digital skills. By addressing gaps in measurement, intervention design, and societal engagement, these studies not only chart pathways for individual empowerment but also highlight systemic challenges that require collective action. Moving forward, interdisciplinary collaboration and ongoing dialogue between researchers, educators, policymakers, and communities will be essential in ensuring that digital literacy initiatives remain adaptable, inclusive, and effective.

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Conflict of Interests

The authors declare no conflict of interests.

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REVIEW

Open Access Journal

Fostering Media Literacy: A Systematic Evidence Review of Intervention Effectiveness for Diverse Target Groups

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Abstract

Investigating the effectiveness of media literacy interventions is essential to identify the most promising programs. This 2022 systematic evidence review, guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guideline, aimed to collect and synthesize scientific evidence on effective media literacy intervention programs across different target groups and the used frameworks. A comprehensive search across major scientific databases (Web of Science, Scopus, ProQuest, Communication & Mass Media Complete, and Education Resources Information Centre) and rigorous screening and coding processes identified 119 studies on media literacy intervention effectiveness and outcomes. This review offers valuable insights into the current state of media literacy intervention research, emphasizing the importance of considering diverse target groups and exploring a wide range of outcomes to enhance our understanding of these interventions' impact.

Keywords
digital skills; effective interventions; impact assessment; media literacy; media literacy interventions; outcomes

1. Introduction

In today's digital era, characterized by an abundance of information and rapid technological advancements, the ability to critically navigate and adequately use media and digital content is crucial. While scholars propose varying definitions of media literacy, there is consensus that it involves specific knowledge and skills facilitating critical comprehension and use of media (Hobbs, 1998; Jeong et al., 2012; Marten, 2010; McCannon, 2009). Media literacy, broadly defined as the ability to access, analyze, evaluate, and create media content, inherently includes digital skills. Digital skills—such as competencies in using digital devices, platforms, and tools—are a key subset of media literacy. Together, they equip individuals to navigate the digital media landscape effectively, enabling informed decision-making and protection against misinformation and digital threats (Helsper et al., 2020).

A media literacy intervention is an educational approach designed to enhance critical thinking by improving knowledge of media, raising awareness of media influence, and honing the ability to assess media representations (Byrne, 2009). These interventions aim to develop individuals' skills to understand media messages, recognize biases, discern credible sources, and understand media effects on individuals and society. Similarly, digital skills interventions focus on empowering individuals with the ability to effectively and safely use digital technologies (Alon et al., 2024). Media literacy, as a broad concept that includes digital skills, combines the ability to critically understand media content and use digital tools effectively. To enhance these skills, various interventions have been implemented in educational, community, and organizational settings, helping diverse populations develop these important competencies.

Theories are a key element of these interventions, as they allow for the precise implementation of pedagogical, andragogical, and geragogical experiments (Passey, 2020). Such theories facilitate the design and implementation of interventions that shape media literacy. Although theories are a valuable and informative foundation for researchers to build and design media literacy interventions, research attests that interventions do not always contain explicit theoretical frameworks that allow for the definition of variables or the interpretation of research findings (Jeong et al., 2012).

Existing systematic reviews and meta-analyses have explored various outcomes of media literacy interventions, focusing on both cognitive and behavioral dimensions. Early work, such as Bergsma and Carney's (2008) systematic review of health-promoting media literacy, assessed the effectiveness of interventions aimed at improving knowledge and attitudes towards health-related content. More recently, Polanco-Levicán and Salvo-Garrido (2022) expanded the scope of media literacy to include social media literacy, emphasizing competencies related to the evaluation and critical consumption of social media content. Both studies contribute to understanding media literacy in specific domains but leave gaps in terms of evaluating the broader impacts of media literacy interventions across diverse contexts and populations. Vahedi et al. (2018) and Xie et al. (2019) provide more recent meta-analyses, extending beyond the work of Jeong et al. (2012). Vahedi et al. (2018) focused on adolescents' risky health behaviors, concluding that

media literacy interventions can change attitudes and intentions regarding health risks. Xie et al. (2019) examined media literacy interventions in the context of deviant behaviors, further highlighting the role of tailored media literacy programs in behavior modification. Both studies underscore the need for interventions that specifically target behavior-related outcomes, yet they do not fully address how these programs work across different demographic groups or in diverse settings.

Previous research has categorized media literacy outcomes into several dimensions, such as knowledge of persuasion, advertising (Buijzen, 2007; Hobbs & Frost, 2003), critical thinking (Austin & Johnson, 1997; Austin, Pinkleton, Hust, & Cohen, 2005), and media influence recognition (Scull, Kupersmidt, & Weatherholt, 2017; Scull, Malik, et al. 2019). Behavioral outcomes, such as changes in attitudes, self-efficacy, and social norms, are also critical (Fishbein & Yzer, 2003). However, as noted by Jeong et al. (2012), media literacy interventions tend to have a stronger effect on media-related outcomes than on behaviors. This finding is supported by studies on practical competencies in digital skills (Haddon et al., 2020; Livingstone et al., 2021), which emphasize the need for integrating safe digital practices into media literacy programs. Despite the valuable contributions of these reviews, there remains a gap in understanding the effectiveness of media literacy interventions across diverse populations. Much of the research, as Edwards et al. (2021) note, focuses on adult participants, with limited attention to minors, youth, or other vulnerable groups. Furthermore, findings rarely account for demographic factors like ethnicity, disability, or socioeconomic status, which are crucial for addressing digital inequalities. Research by Ayala and Elder (2011) shows that interventions not tailored to specific target groups often fail to meet their objectives, emphasizing the importance of designing programs that account for the experiences and needs of diverse populations.

The present review addresses these gaps by systematically evaluating media literacy interventions across multiple contexts, with a particular focus on the inclusion of diverse and vulnerable groups. By assessing empirical studies published between 2012 and 2022, this review builds a robust evidence base on the outcomes of media literacy interventions and identifies the characteristics of successful programs. This research aims to inform the design, implementation, and evaluation of future interventions, offering insights into the broader societal implications of media literacy, including its role in addressing digital inequalities, misinformation, and digital citizenship. Accordingly, the present systematic evidence review was conducted with the following objectives: (a) To build a robust evidence base on the outcomes of media literacy interventions, and (b) to identify the characteristics of potentially effective media literacy intervention programs that lead to positive outcomes across diverse contexts. The specific research questions are:

> RQ1: What characteristics of media literacy intervention programs contribute to achieving positive outcomes?
>
> RQ2: How do variations in context influence the effectiveness of media literacy interventions?

2. Methodology

The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009), which are widely used to ensure transparency and rigor in systematic reviews. PRISMA provides a structured approach for selecting, analyzing, and reporting studies, focusing on clarity in the presentation of the search strategy, inclusion criteria, data extraction, and synthesis of findings.

By adhering to these guidelines, this review ensures a comprehensive and systematic approach to analyzing media literacy interventions (See Supplementary File, Appendix 1).

2.1. Article Search and Study Eligibility Criteria

Article search included elaborating a search phrase, identifying and searching the relevant databases, and applying relevant filters to keep the search focused. The search stage started with the identification of key concepts related to the research questions. The search phrase, which incorporated a wide array of terms, was elaborated to ensure comprehensive coverage of the relevant media literacy studies. These concepts include keywords such as (a) "media literacy and digital skills," (b) "intervention," (c) "experimental," and (d) terms to exclude certain studies, specifically "medical." Each key term was paired with all possible synonyms, forming a detailed search phrase (see Supplementary File, Appendix 2, for more details).

Using the specified search terms, articles were obtained from various databases (including Web of Science, Scopus, ProQuest, Communication & Mass Media Complete, and Education Resources Information Centre). The search was further refined using specific eligibility criteria, including publication dates between 2012 and 2022, publications in English, and sources from peer-reviewed journals or conference proceedings. The search was conducted in December 2022.

2.2. Study Selection

2.2.1. Inclusion and Exclusion Criteria

Inclusion criteria were established to screen and select relevant studies for final analysis, ensuring alignment with the research questions at each stage. The inclusion/exclusion was applied in a cascading fashion, excluding studies at each stage if they failed to meet the initial criteria.

Initially, titles and abstracts were evaluated using the first set of selection criteria, excluding studies focused solely on media use or unrelated skills. Only studies about interventions aimed at teaching, developing, or stimulating media literacy and digital skills, and using quantitative methods such as experiments, quasi-experiments, or surveys, were included. Studies that did not meet these criteria were excluded. In the second stage, full texts were screened with an extended list of criteria, including quality appraisal based on Gough's (2007) weight of evidence framework. Studies needed clear definitions, measures, theoretical bases for media literacy and digital skills, and in-depth descriptions of interventions and their effectiveness. Only experimental or quasi-experimental methodologies comparing at least two conditions (treatment and control groups) were included. Studies also needed to address selection bias, include statistical significance testing, relevant control variables, and report main findings with effect sizes or statistical data.

The coding framework distinguished seven initial outcome categories: civic/participatory, economic/employment, education/learning, media literacy and digital skills, physical well-being, psychological well-being, and socio-cultural well-being. This approach, shaped by a wide body of research to capture positive outcomes across various life domains, ensured that the coding framework reflected the broader range of potential impacts of media literacy interventions. The "other" option was included for outcomes not fitting these categories. Following analysis of the "other" category, two additional outcome categories were

added: Cognitive outcomes and Technology acceptance. The emergence of these categories highlights the review's responsiveness to findings that were not initially anticipated, ensuring a comprehensive analysis rather than merely adhering to initial preconceptions. Civic/participatory outcomes include digital citizenship performance and perceptions of partisanship. Education and learning outcomes involve variables such as literacy and perceived learning. Media literacy and digital skills outcomes cover digital literacy, programming skills, and attitudes about online risks. Physical well-being outcomes include subjective health and attitudes towards e.g., smoking. Psychological well-being outcomes consist of body image, confidence, and social comparison. Socio-cultural well-being outcomes involve bystander intentions and gender role norms. Cognitive outcomes encompass mental effort (e.g., processing information), flow, and self-efficacy. Technology acceptance outcomes include perceived usefulness, perceived ease of use, and user satisfaction.

2.2.2. Selection Stages

The initial search across databases yielded 5,890 results. After removing duplicates and retractions, 4,878 unique results were screened. After applying the selection criteria, 119 studies were included in the final pool of studies to be reviewed (see Supplementary File, Appendix 3, for a summary of the selected studies). The whole process of screening and data on study inclusion/exclusions is captured in the Supplementary File, Appendix 1.

2.3. Reliability of Screening: Intercoder Reliability

Six teams, each consisting of two to three coders, assessed intercoder reliability for inclusion/exclusion decisions at both the title and abstract level and the full-text level. Abstracts and articles were randomly selected from the pool of eligible articles, and Fleiss' kappa (κ) was calculated using JASP (version 0.17.1; JASP, 2024). Three rounds of screening were conducted to achieve substantial agreement between coders, reaching a Fleiss' κ of 0.63, based on Landis and Koch's criteria (Landis & Koch, 1977). Notes were kept on inclusion or exclusion reasons, and after each round, team discussions resolved uncertain cases.

In the final round, 451 articles (approximately 9.2% of the total 4,878 abstracts) were screened. After the third round, all remaining abstracts were screened for full-text eligibility. To assess intercoder reliability at the full-text level, 72 articles (approximately 10.6% of the total 678 articles) were screened. The initial round yielded a substantial agreement with a Fleiss' κ of 0.79. Following thorough team discussions to resolve any differences, full-text screening was conducted on all remaining studies, resulting in 119 studies being selected for final coding and analysis.

2.4. Data Collection: Coding Frame for Data Extraction

The final 119 studies were coded and analyzed using a framework developed from literature consultations and observations during the full-text screening. This framework comprised five main sections: article information, intervention characterization, methodology, intervention outcomes, and potential drivers or enablers of the intervention effects. The article information section captured details such as authors, study title, publication name, and study/publication quality. The intervention characterization section gathered data on targeted skills, target groups, intervention procedures, and other relevant elements.

The methodology section provided information on reviewed study design, data collection methods, and sample size. The largest section, focusing on intervention outcomes, recorded the measured outcomes, including the type of effect (within-group, between-groups, or interaction) and the statistical information needed to evaluate effect size. The final section concentrated on potential drivers or enablers of intervention effects, such as mediators and moderators. Coding was performed using Qualtrics software (Qualtrics, 2022), where a questionnaire capturing the required information was filled out for each study. The completed dataset was then exported to SPSS and Excel for further analysis.

2.5. Data Analysis

In addition to descriptive analysis, the data exploration primarily involved calculating the effect sizes of the identified interventions and factors on media literacy of various target groups, using the statistical data collected from the studies. Effect sizes for each outcome were gathered from the articles. When effect sizes were not reported, but other statistical information such as means, standard deviations, and sample sizes were available, effect sizes were calculated using an online calculator. The calculated effect sizes were reported as Cohen's *d* (Cohen, 1988), partial eta squared (Olejnik & Algina, 2003), or difference-in-difference. Effect sizes were interpreted using established thresholds (see Supplementary File, Appendix 4, for effect sizes thresholds).

Such analysis allowed for determining the significance of the interventions' effects and assessing the reliability of their impact across various outcomes, providing a robust basis for interpreting the effectiveness of each intervention.

3. Results

The results in this section are organized into three subsections: (a) the use of theoretical frameworks in media literacy interventions, (b) the effectiveness of interventions across various outcome categories, (c) and the effectiveness of interventions across different target groups.

3.1. Theoretical Frameworks

Although theories are a valuable and informative foundation for researchers to build and design media literacy interventions, 25.86% of the articles analyzed did not contain explicit references to theoretical frameworks that allow for the definition of variables or the interpretation of research findings. Forty-seven point twenty-two percent of the theoretical frameworks are linked directly to disciplines such as media studies, media psychology, media pedagogy, and media sociology. In contrast, 52.78% were "auxiliary" theories from other socio-humanities. The remaining 26.92% of the articles utilized general guiding principles i.e., instead of explicitly applying a specific theory, the articles have drawn on theoretical concepts without fully integrating or naming the framework.

The most frequently used theories were self-regulation within the context of social learning theories, the message interpretation process model, and various approaches to media literacy, each appearing in 9.72% of the articles. This was followed by the theory of planned behavior, cited in 8.33% of the studies. Additionally,

the Technological Pedagogical and Content Knowledge Framework appeared in 6.94% of the articles analyzed. A full overview of the theoretical frameworks is discussed by Vissenberg et al. (2023).

3.2. Effectiveness of Interventions Across Outcome Categories

We analyzed 119 studies examining the outcomes of media literacy interventions. On average, each study measured 3.5 different outcomes. Many outcomes were assessed using scales composed of several individual measurement items. When information on a composite variable was available, it was counted as a single measured outcome. In the absence of composite variable information, each individual measurement item was counted separately, explaining the high number of outcomes reported in some studies. Additional descriptive data and information on the effectiveness of the interventions are detailed in the following subsections.

Among the 119 studies, outcomes related to media literacy and digital skills were most frequently tested. These studies assessed 364 outcomes linked to media literacy and digital skills, accounting for 53.7% of the 678 effects studied. It is worth noting that the reported 678 effects pertain to the "effects studied" rather than the "papers/articles studied." A single article may investigate multiple effects of an intervention, which is why the total number of effects examined exceeds the 119 individual studies.

Out of the 678 effects of media literacy interventions across eight outcome types, 292 (43.1%) were non-significant, 180 (26.5%) were small effects, 79 (11.7%) were medium-sized effects, and 88 (13%) were large effects. For 39 effects (5.8%), no effect size was reported, and insufficient information was available for calculation. Figure 1 displays the number of outcomes and the effect sizes for each of the eight outcome categories.

Outcomes related to media literacy and digital skills were the most frequently tested, with 364 outcomes assessed, accounting for 53.7% of all 678 effects studied. For 27 outcomes (7.4%), no effect size was reported,

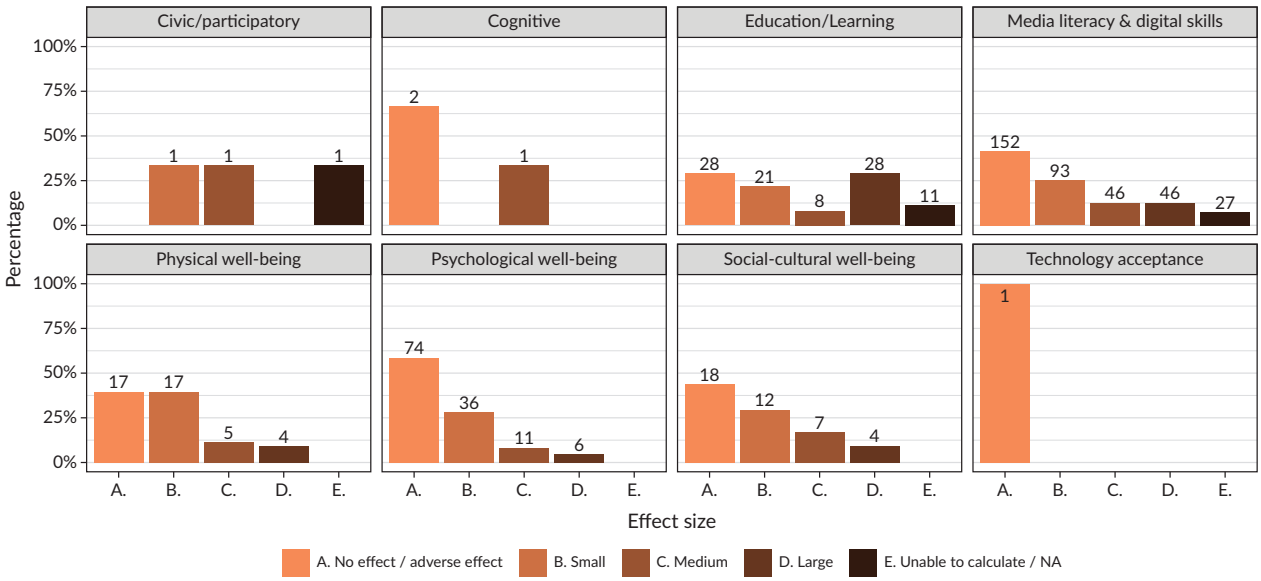

Figure 1. Effect size categories by outcome type.

and insufficient information prevented calculation. Of the tested outcomes, 152 (41.7%) were non-significant or adverse, 93 (25.5%) were small, 46 (12.6%) were medium, and 46 (12.6%) were large.

Psychological well-being outcomes were the second most frequently tested, with 127 outcomes examined (18.7% of all effects). For the majority (74 outcomes, 58.3%), no significant effects were found. Small effects were reported for 36 outcomes (28.3%), medium effects for 11 outcomes (8.7%), and large effects for six outcomes (4.7%).

Education and learning outcomes were the third most frequently tested, with 96 outcomes assessed. For 28 outcomes (29.2%), no effects were reported. Small effects were found for 21 outcomes (21.9%), medium effects for eight outcomes (8.3%), and large effects for 28 outcomes (29.2%). For 11 outcomes (11.5%), insufficient information was available to calculate the effect size.

Outcomes related to physical well-being (43 outcomes, 6.3%) and socio-cultural well-being (41 outcomes, 6%) were also tested. However, civic/participatory outcomes (three outcomes, 0.5%), cognitive outcomes (three outcomes, 0.5%), and technology acceptance outcomes (one outcome, 0.1%) were considered only sporadically.

3.3. Effectiveness of Interventions Across Target Groups

The following nine target groups were defined for further analysis of intervention effectiveness (expressed through effect size): children, youths, college students, (pre-service) teachers, young adults, adults, older adults, parents, and the general public. Figure 2 presents the effects of media literacy interventions on the eight outcome types for "children," defined as participants younger than 12 years old. Across the 119 studies, 94 effects were measured with child participants.

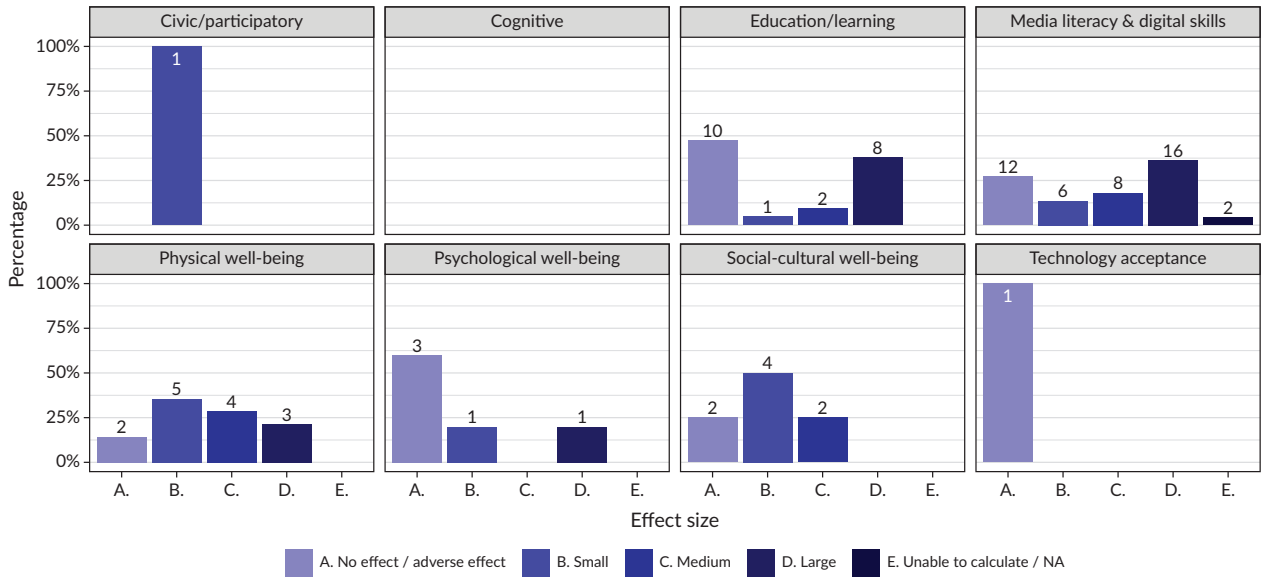

Figure 2. Effect size categories by outcome type for children.

Most effects were measured in the media literacy and digital skills category (44 effects, 46.8%) and the education and learning category (21 effects, 22.3%). Both categories showed a high number of large effects: 16 large effects on media literacy and digital skills (36.4% of all effects in this category) and eight large effects on education/learning outcomes (38.1%).

Fewer effects were measured for children in physical well-being (14 effects, 14.9%), psychological well-being (five effects, 5.3%), and socio-cultural well-being (eight effects, 8.5%). Only one effect was tested for civic/participatory outcomes (1.1%) and technology acceptance outcomes (1.1%). No effects on cognitive outcomes were tested in children.

Figure 3 displays the effects of media literacy interventions on the eight outcome types for "youths," defined as individuals aged 12 to 17, typically attending secondary education. Across the 119 studies, 290 effects were measured with youth participants. Two outcome categories were tested significantly more than others: media literacy and digital skills (141 effects, 48.6%) and psychological well-being (66 effects, 22.8%). While psychological well-being was sporadically tested in children, it is more frequently assessed in youths.

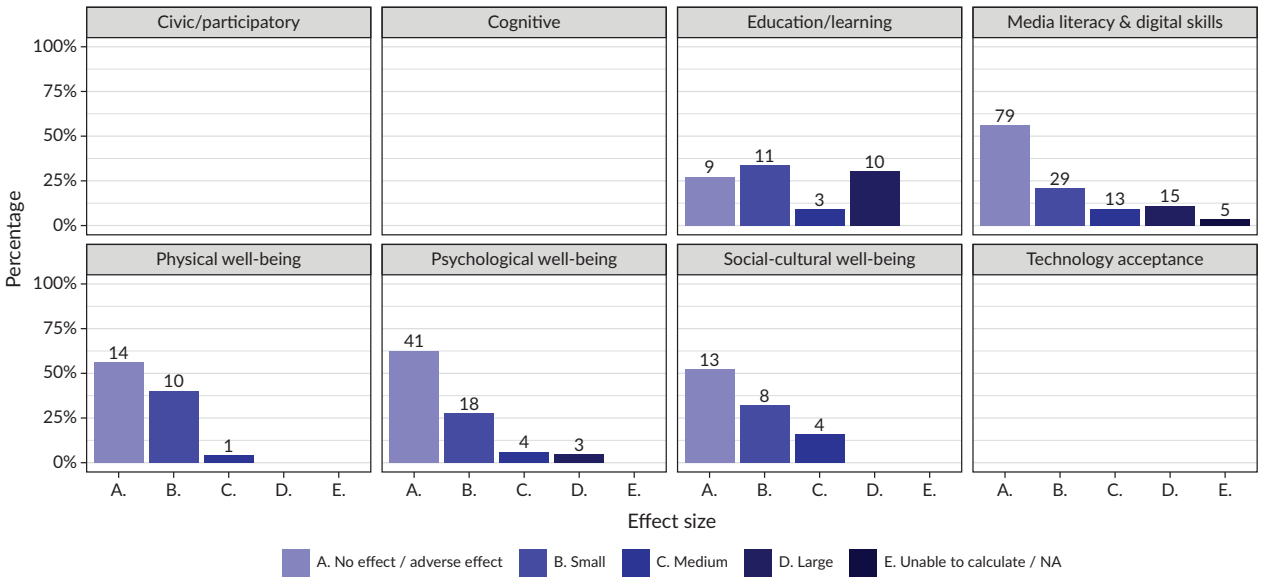

Figure 3. Effect size categories by outcome type for youths.

Other outcome categories included education/learning (33 effects, 11.4%), physical well-being (25 effects, 8.6%), and socio-cultural well-being (25 effects, 8.6%). Interestingly, the largest proportion of large effects was found in education/learning outcomes (10 effects, 30.3% of all education/learning outcomes), indicating a strong impact of media literacy interventions in this area despite fewer tests.

No effects were reported for civic/participatory outcomes, cognitive outcomes, and technology acceptance outcomes.

Figure 4 presents the effects of media literacy interventions on eight outcome types for "college students," defined as individuals attending higher education institutions, including colleges and universities. Across the 119 studies, 99 effects were tested for college students. The majority of effects were tested for media

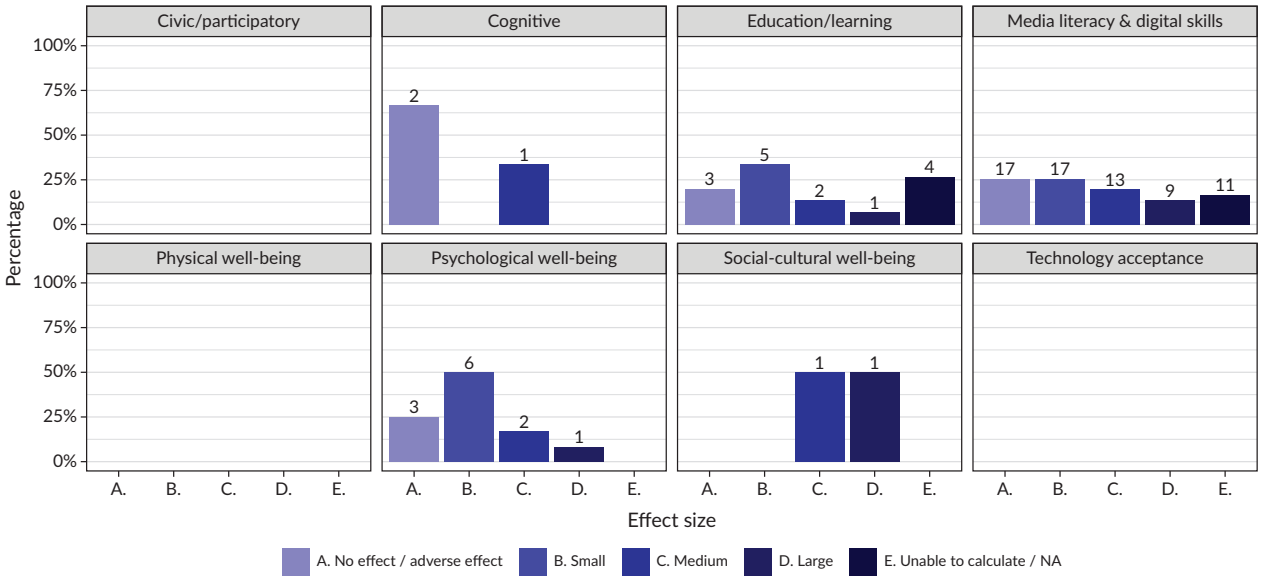

Figure 4. Effect size categories by outcome type for college students.

literacy and digital skills (67 effects, 67.7%). Outcomes related to education/learning (15 effects, 15.2%) and psychological well-being (12 effects, 12.1%) were also considered, though to a lesser extent. Effects related to cognitive outcomes (three effects, 3%) and socio-cultural well-being (two effects, 2%) were tested only sporadically. No effects were tested for civic/participatory, physical well-being, or technology acceptance outcomes.

The fourth target group identified in the analysis of 119 studies comprises "(future) teachers." Figure 5 displays the effects of media literacy interventions on this group. Compared to children, youths, and college students, the number of effects tested for teachers is lower and limited to only half of the outcome categories. In total, 36 effects of media literacy interventions on four out of the eight outcome types were measured. The majority

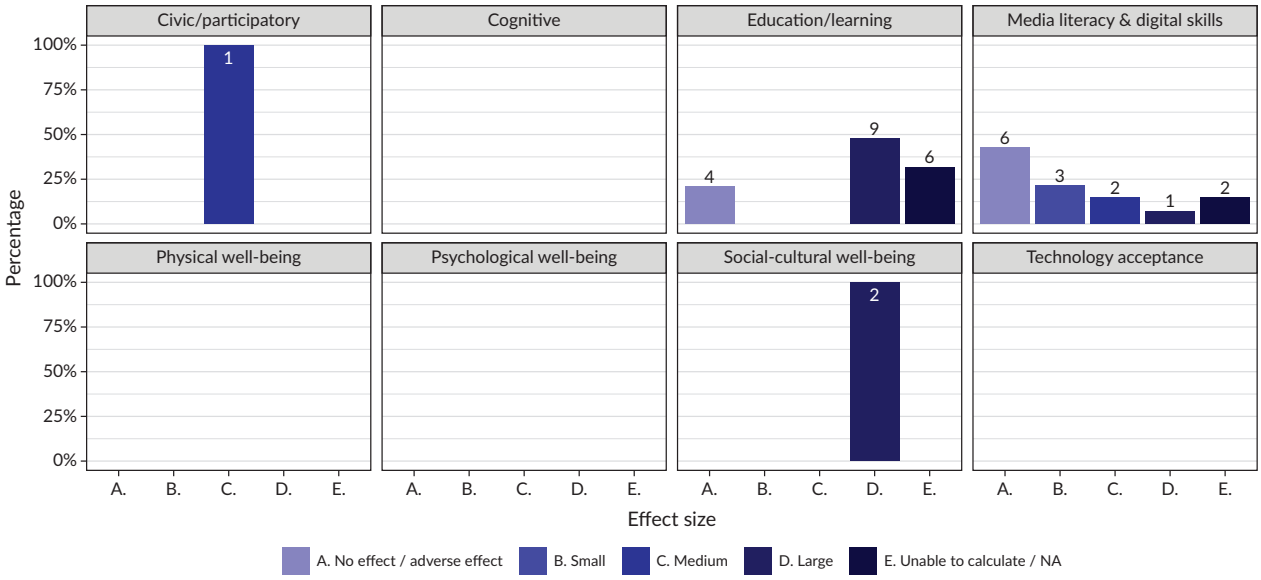

Figure 5. Effect size categories by outcome type for (future) teachers.

were concentrated within education/learning outcomes (19 effects, 52.8%) and media literacy and digital skills outcomes (14 effects, 38.9%). Only one effect was tested for civic/participatory outcomes (2.8%), and two effects for socio-cultural well-being outcomes (5.5%). Interestingly, the effect sizes for teachers tend to be larger: 27.8% of effects were non-significant, 8.3% were small, 8.3% were medium, and 33.3% were large. This contrasts with the proportions of large effects in other groups: 12.1% in college students, 9.6% in youths, and 29.8% in children.

Figure 6 presents the effects of media literacy interventions on "young adults" across eight outcome types. Only seven effects were tested for this group, possibly because many young adults are enrolled in higher education and thus included in the college student category. Additionally, college students are easier to recruit for research studies, leading to their primary inclusion in that target group rather than the broader young adult category. The seven effects were spread across three outcome categories: education/learning (one effect), media literacy and digital skills (four effects), and psychological well-being (two effects). Interestingly, only one of these seven effects was non-significant (14.3%).

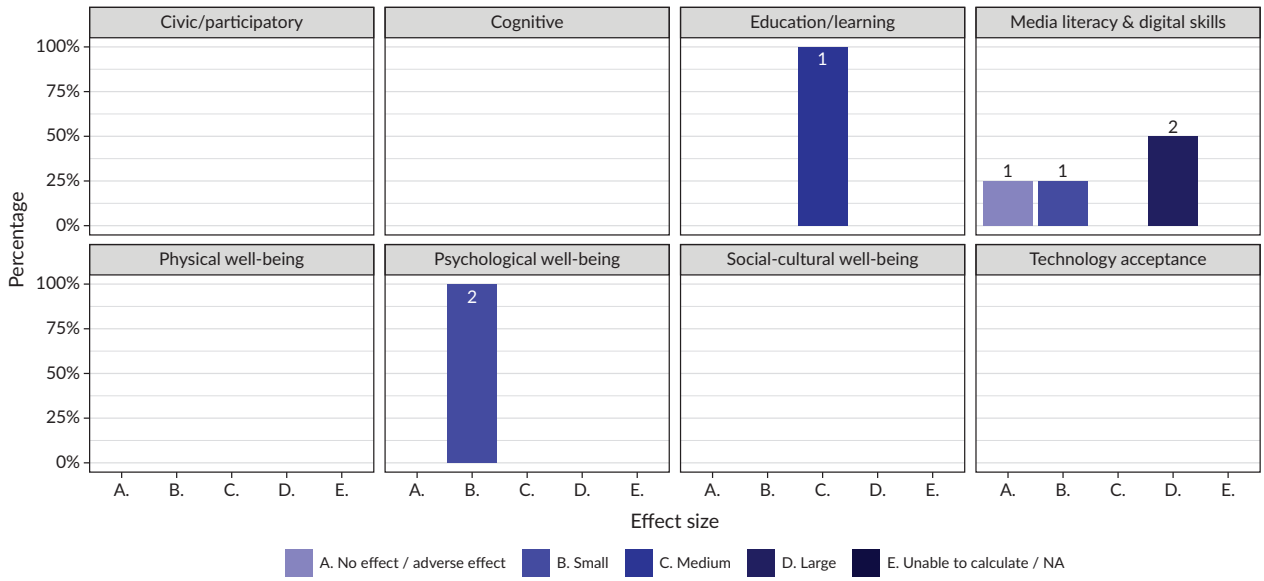

Figure 6. Effect size categories by outcome type for young adults.

The next target group for media literacy interventions considered in the 119 studies is "adults." Figure 7 displays the effects of these interventions across eight outcome types. A total of 61 effects were tested for adults, with the majority related to media literacy and digital skills (62.3%) and psychological well-being (31.1%). Only one effect was tested for civic/participatory outcomes (1.6%), and three for socio-cultural well-being outcomes (4.9%). Compared to other target groups, the proportion of larger effect sizes for adults is small, with no large effects and only one medium-sized effect (1.6%). The majority of effects were non-significant (60.7%) or small (26.2%).

Figure 8 presents the effects of media literacy interventions on "older adults" across eight outcome types from the 119 studies analyzed. In total, only 24 effects were tested for this target group. The majority were related to media literacy and digital skills (12 effects, 50%) and psychological well-being (eight effects, 33.3%). Effects on media literacy and digital skills were primarily small (four effects, 33.3%) or medium-sized (four effects, 33.3%),

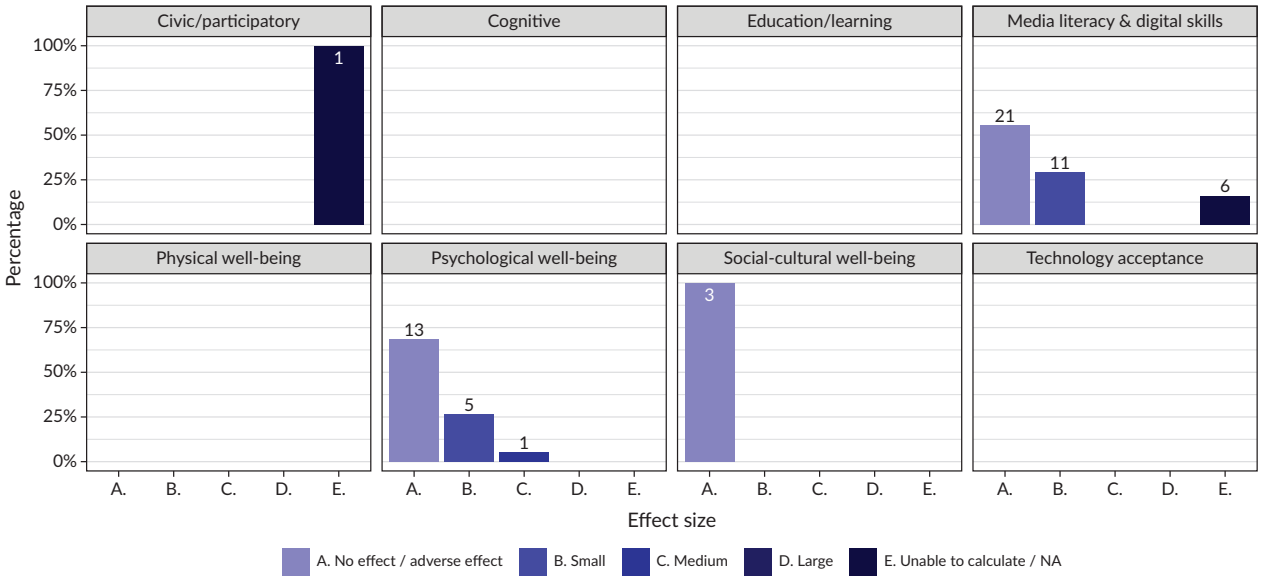

Figure 7. Effect size categories by outcome type for adults.

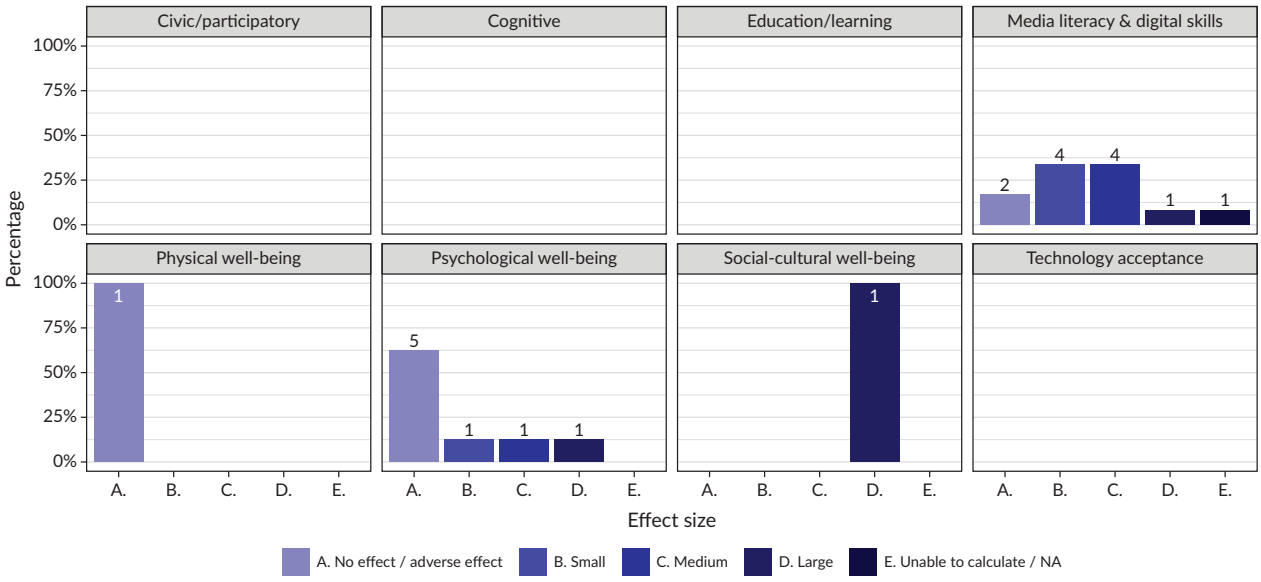

Figure 8. Effect size categories by outcome type for older adults.

while most effects on psychological well-being were non-significant (five effects, 62.5%). Only one effect was tested for physical well-being (4.2%) and one for socio-cultural well-being (4.2%). No effects were tested for civic/participatory, cognitive, education/learning, or technology acceptance outcomes in older adults.

The next target group in the 119 studies testing media literacy interventions is "parents" (Figure 9). Parents are significantly underrepresented, with only six effects tested across two outcome types. Specifically, one effect was found for media literacy and digital skills (16.7%), and five effects for education/learning outcomes (83.3%). These effects were either non-significant (three effects, 50%) or small (two effects, 33.3%). One effect lacked an effect size and sufficient information for calculation. No outcomes related to

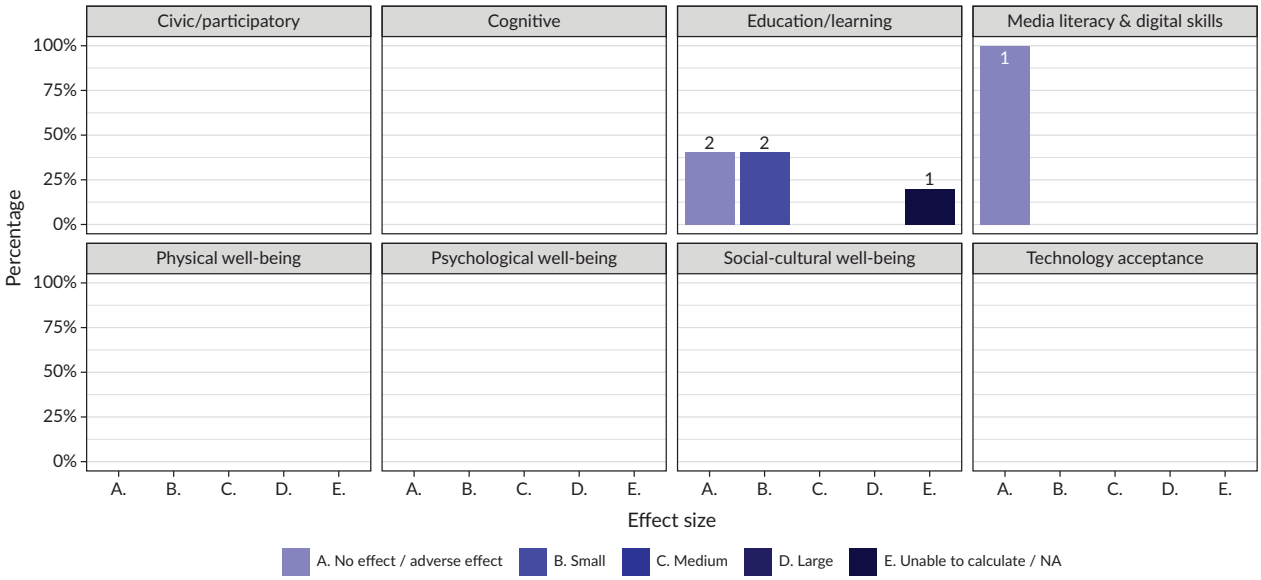

Figure 9. Effect size categories by outcome category for parents.

civic participation, cognitive abilities, physical well-being, psychological well-being, socio-cultural well-being, or technology acceptance were tested for parents.

The final target group identified in the analysis of the 119 studies is the "general public." Figure 10 illustrates the impact of media literacy interventions on this group. A total of 18 effects were identified, all related to media literacy and digital skills outcomes. Of these, half (nine effects, 50%) were non-significant. Additionally, four effects (22.2%) were small, four effects (22.2%) were medium, and one effect (5.6%) was large.

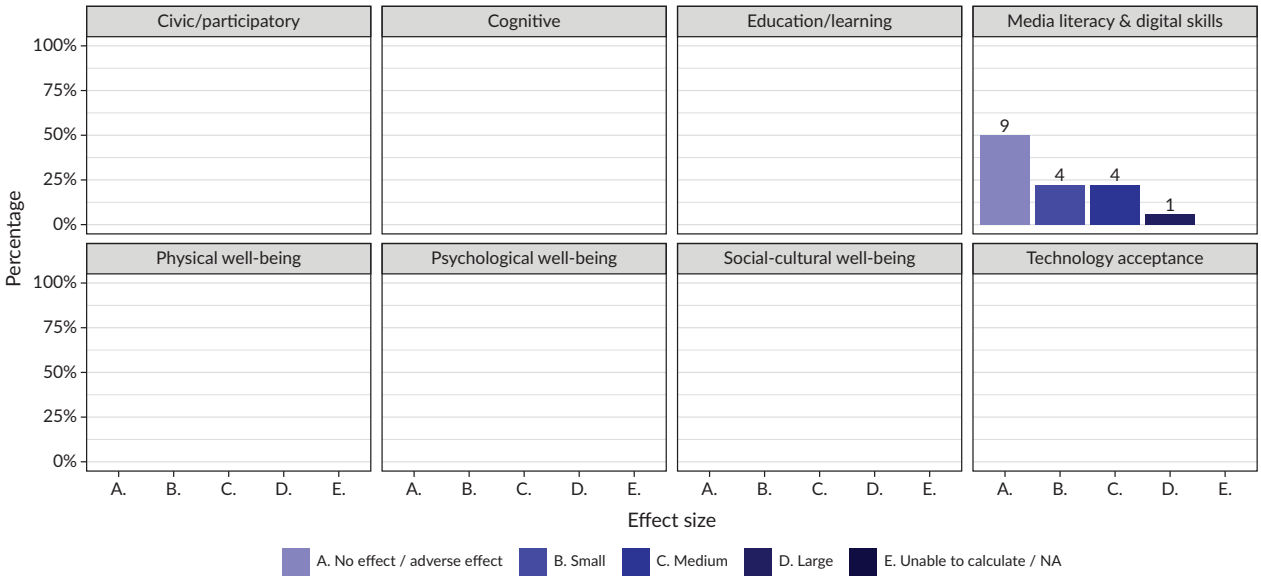

Figure 10. Effect size categories by outcome category for the public in general.

4. Discussion

4.1. Discussion of Findings

This systematic review aimed to synthesize evidence on effective media literacy intervention programs. By analyzing 119 studies, we identified several critical insights and implications for future research and practice.

A solid theoretical foundation is crucial for effective media literacy interventions. Theories help guide the design, implementation, and evaluation of these interventions in three ways: they shape conceptual frameworks, provide guidance in elaborating/adopting the right research tools and methods (e.g., pre- and post-tests), and enable deeper interpretation of results. While most studies in this review adopted theoretical frameworks, a minority did not, which may limit their ability to explore media literacy-related phenomena. Theories like Bandura's (1977) social learning theory and the message interpretation process model (Austin, Pinkleton, & Funabiki, 2007) are frequently used to understand media literacy outcomes. Theories such as planned behavior (Ajzen & Fishbein, 1975) and technological pedagogical and content knowledge (Mishra & Koehler, 2006) address digital competence.

Among the 119 studies, media literacy outcomes were the most examined. Following closely, outcomes concerning psychological well-being and education/learning were the second and third most extensively examined, respectively. This reflects the increasing importance of these skills in today's digital world. As individuals rely more on digital media and technology, the ability to navigate digital platforms, critically evaluate online content, and use digital tools effectively has become essential (Kirschner & De Bruyckere, 2017). Buckingham (2013) also stresses the need for media education to develop critical thinking and participatory skills in digital environments.

Researchers targeting specific digital skills naturally aim to test whether these skills improve due to the intervention, aligning with Jeong et al.'s (2012) argument about the focus on media-relevant outcomes. However, our findings challenge the assumption that media literacy interventions universally lead to positive outcomes. Despite expectations, a significant proportion of the outcomes showed no significant effect, suggesting that the effectiveness of these interventions may depend on various factors. This contrasts with Jeong et al.'s (2012) meta-analysis, which suggested that media literacy interventions generally produce favorable outcomes. Similarly, while the systematic review by Vahedi et al. (2018) found that interventions significantly improved media literacy skills and had smaller, yet positive effects on attitudes and behavioral intentions, our findings suggest a more nuanced reality. The discrepancies between these studies and ours highlight the importance of understanding the specific conditions under which media literacy interventions succeed. As Potter (2010) emphasizes, contextual factors and methodological rigor are crucial in evaluating the effectiveness of such interventions. In line with this, the meta-analysis by Xie et al. (2019) illustrated that media literacy interventions moderately reduce adolescent deviant behaviors and maintain effects over time, reinforcing the potential of these programs. However, our study underscores that universal positive outcomes should not be assumed without a deeper investigation into the underlying mechanisms that drive success. These findings collectively suggest that while media literacy education holds promise, a more detailed examination of the strategies and contexts that enhance intervention effectiveness is necessary.

The emphasis on psychological well-being and education/learning outcomes highlights the link between media use, mental health, and educational achievements. Rising concerns about digital media's impact on mental health, such as increased stress, anxiety, or depression, have prompted researchers to investigate these areas more thoroughly. Primack et al. (2009) found a significant association between media use and depression in young adults, emphasizing the importance of understanding these psychological impacts. However, based on our results, for the majority of these outcomes, no significant effects were reported. Another systematic review and meta-analysis of interventions with digital tools for mental health promotion among 11–18-year-olds also showed that small, but promising, effects of digital tools were found with respect to promoting well-being, relieving anxiety, and enhancing protective factors (Wright et al., 2023). There is a rising awareness of mental health issues globally, prompting more research into factors that influence psychological well-being. Studies have shown that media consumption and digital interactions significantly impact mental health (Zsila & Reyes, 2023), necessitating interventions that enhance media literacy and digital skills to mitigate negative effects.

Additionally, the integration of digital technologies into education has driven a focus on how these interventions influence educational outcomes and learning processes. Based on our results, only about 38% of the evaluated outcomes were effective and the remaining 62% of outcomes had no effect, small effect or we were not able to calculate the outcome effectiveness. This is sometimes in contrast with previous research such as a study by Tran-Duong (2023) who explored the impact of media literacy on effective learning outcomes in online learning. The author suggested that the four-factor construct of media literacy (functional consumption, critical consumption, critical prosumption, and functional prosumption) significantly influenced perceived learning outcomes among undergraduate students.

Furthermore, the review identified a considerable lack of studies examining outcomes such as civic/participatory engagement, physical well-being, and socio-cultural well-being. This gap highlights the need for broader outcome measures in future research to fully understand the multifaceted impact of media literacy interventions. Future studies should diversify their investigations to capture a wider range of impacts.

The analysis also revealed variations in outcomes across different target groups, ranging from children to older adults, including college students, teachers, and parents. Although previous evidence demonstrates that media literacy interventions were effective across a spectrum of age groups (Jeong et al., 2012), the results of the present study showed that the types of outcomes that are most represented in research differ with varying effectiveness depending on the target group under study, although outcomes relating to media literacy continue to dominate. For instance, for children, youths, and college students, more studies reported on outcomes relating to education and learning than for older age groups. As for their effectiveness, about 48% effects of the interventions emerged as medium and large for children. This figure was less for youth and college students indicating that more studies reported positive outcomes relating to education and learning for children compared to older age groups. These findings suggest that media literacy interventions may be more impactful for younger age groups, particularly children, in terms of educational and learning outcomes. This pattern could be due to several factors, including cognitive development stages (Buckingham, 2013), the design and delivery of interventions (Potter, 2004), and the media consumption habits of different age groups (Palfrey & Gasser, 2008).

While this pattern of larger effect sizes for specific target groups was not consistent across all outcomes and groups, it suggests that careful consideration and specification of target groups in designing and testing interventions can enhance the likelihood of achieving stronger positive effects. Future research should specifically consider the target groups or beneficiaries of media literacy interventions when evaluating their outcomes.

4.2. Study Limitations

This study presents several limitations that must be acknowledged. Firstly, the search was confined to English-language publications, potentially omitting relevant studies conducted in other languages. Future research should endeavor to broaden its scope by conducting searches across multiple languages to ensure a comprehensive review of media literacy intervention literature. Secondly, the review primarily focused on quantitative research, neglecting qualitative methodologies such as interviews or observations. While quantitative studies offer valuable insights, qualitative approaches can provide nuanced perspectives on participants' experiences. Incorporating qualitative methodologies in future studies will enrich our understanding of the impact of media literacy interventions.

Thirdly, despite efforts to be exhaustive, it is possible that some relevant studies were missed in the review process. This could be due to limitations in database coverage or accessibility issues. To mitigate this, future research should employ diverse search strategies and consider alternative sources to capture a broader range of studies. Lastly, the eligibility screening and coding process involved multiple researchers, potentially introducing subjectivity. Despite attempts to ensure consistency, individual judgments may have influenced study selection and interpretation. Enhancing methodological rigor through standardized procedures and transparent reporting is imperative for future research endeavors.

4.3. Future Research

Future research should explore emerging areas in media literacy interventions, including long-term effects, potential mediators and moderators of outcomes, and innovative intervention delivery methods. By addressing these limitations and advancing research in these areas, we can further our understanding of effective strategies for enhancing media literacy and digital skills across diverse populations.

5. Conclusions and Recommendations

Overall, the study highlights the need for a multifaceted approach to media literacy interventions, informed by diverse theoretical frameworks and tailored to diverse target groups. To advance the field, future research should prioritize methodological rigor, incorporate a broader range of outcome measures, and explore mediators and moderators influencing intervention effects. To optimize the efficacy of media literacy interventions, the following recommendations are proposed.

First, intervention providers should draw upon diverse theoretical frameworks from fields such as media studies, media psychology, and pedagogical science to inform the design and implementation of media literacy interventions. By incorporating multiple perspectives, interventions can better address the multifaceted nature of media literacy and digital skills. Theoretical frameworks enhance the depth and rigor of interventions, contributing to more effective learning and skill development across diverse populations.

Second, interventions should be tailored to specific target groups, considering factors such as age, gender, and socio-economic background. By addressing the unique needs and preferences of different demographics, interventions can maximize their effectiveness and relevance. Based on the reviewed studies, we identified several factors that differentiated successful interventions, such as the use of culturally relevant content for minority groups, interactive methods for younger audiences, and a focus on practical digital skills for older adults, providing concrete strategies for researchers and practitioners.

Third, researchers should prioritize methodological rigor in study design and implementation, including the use of randomized controlled trials and consistent reporting of effect sizes. Robust experimental designs are essential for drawing reliable conclusions about intervention effectiveness.

Fourth, future research should incorporate a broader range of outcome measures beyond media and digital literacy, including civic engagement, physical well-being, and socio-cultural well-being, to capture the holistic impact of media literacy interventions. The inclusion criteria for this review were designed to focus on media literacy interventions, but with a wide scope, encompassing positive outcomes across various life domains. This approach reflects the understanding that media literacy interventions often have far-reaching effects beyond just media and digital skills, influencing multiple aspects of individual and societal well-being.

Fifth, researchers should explore mediators and moderators influencing intervention effects, such as gender, socio-economic status, and prior media exposure. Understanding these factors can help identify key mechanisms driving intervention effectiveness and inform targeted intervention strategies.

Finally, collaboration across disciplines, including education, psychology, sociology, and communication, can enrich intervention research on media literacy and promote innovative approaches. Interdisciplinary collaboration can facilitate a holistic understanding of media literacy and digital skills and foster the development of comprehensive intervention strategies.

By implementing these recommendations, intervention providers can develop more effective programs that address the complex challenges of navigating today's digital landscape and promote media literacy and digital skills among diverse populations.

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Conflict of Interests

The authors declare no conflict of interests. In this article, editorial decisions were undertaken by Willem Joris (Vrije Universiteit Brussel).

Supplementary Material

Supplementary material for this article is available online in the format provided by the author (unedited). The Supplementary File comprises Appendix 1 (PRISMA flow diagram), Appendix 2 (search terms), Appendix 3 (summary of the reviewed studies), and Appendix 4 (effect sizes thresholds).

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REVIEW

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Beyond Numeracy, a Data Literacy Topical Scoping Review (2011–2023)

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Abstract

As society increasingly recognises the value of data, proficiency in using and understanding data has become crucial. However, there is no universal consensus on the definition of data literacy. Therefore, this study provides the first extensive, mixed methods scoping review of the topical evolution of data literacy within social and educational sciences from 2011 to 2023. By identifying key themes and research trends, this review offers a comprehensive understanding of the dynamic nature of data literacy. Our sample consists of 210 English-language, peer-reviewed articles from Scopus and Web of Science. The findings reveal a field that is evolving alongside media and digital literacy discussions, with notable growth in publications, particularly in 2019, 2020, and 2023, thus highlighting data literacy's recognition as a distinct paradigm. Data literacy is shifting beyond traditional frameworks, with increasing attention to issues of equity and accessibility—areas still underexplored in current literature. Notably, the research demonstrates a shift from simply developing individual data skills to fostering a socially aware form of data literacy that empowers citizens to critically engage with data and navigate a datafied society actively and responsibly. This review emphasises the need for a nuanced, context-specific approach to data literacy, much like digital literacy, as different demographics and contexts encounter varying needs and challenges. As a dynamic, ever-evolving concept, future research and programs must address these diverse levels of engagement and expertise, ensuring that data literacy is inclusive, adaptable, and supported by social structures.

Keywords

data literacy; data skills; media education; topical evolution; understanding data; using data

1. Introduction

There is an increasing importance of data literacy in today's datafied society (Bhargava et al., 2015; Gray et al., 2018). Data is used across various fields and areas of society, such as in business, policy, and education, and employers are increasingly seeking data-literate employees (Ghodoosi et al., 2023). As a result, data literacy is a concept that has gained traction over the years and is discussed across different disciplines and contexts (Wolff et al., 2016). However, as with the discourse on media literacy (van Dijk, 2020), data literacy has been going through a conceptual evolution, with authors not agreeing on a unified definition or framework. This evolution goes hand in hand with societal changes, such as the emergence of big data and AI, and various disciplines, such as those within social sciences, are starting to pay more attention to the concept. Over the years, various aspects have been emphasised within the definition of data literacy. Earlier definitions mainly focus on data analysis skills (Schield, 2004), while more recent definitions include the competences to understand the individual implications of data (Seymoens et al., 2020). Other related concepts also emerged that were sometimes used interchangeably, such as information literacy (Carlson et al., 2011; Schield, 2004). In their meta-review, Wuyckens et al. (2022) find that there is a conceptual confusion and lack of clarity around media literacy, information literacy, and digital literacy.

On the conceptual ambiguity surrounding different types of digital literacies, Mensonides et al. (2024) traced the historical development of media, information, and digital literacies. They emphasise the need for digital literacies to be flexible and adaptable to the challenges posed by new technologies and to be recontextualised. The authors argue for a shift away from one-size-fits-all understandings of digital literacies, proposing instead that these concepts should be understood as socially situated pedagogical processes able to change and evolve and be influenced by societal changes and contexts (Mensonides et al., 2024). Similar to the understanding of information literacy and other forms of literacy (Wuyckens et al., 2022), data literacy has been defined and interpreted in various ways, with no clear consensus on its scope or the specific competences it entails (Bawden, 2001; Mensonides et al., 2024; Van Audenhove et al., 2020). Due to the specific challenges posed by the increasing availability and complexity of data, academic discourse has been calling for a separate definition (Koltay, 2015). There is a need to distinguish it from other literacies and ensure a comprehensive understanding of its meaning.

Therefore, the purpose of the study is to provide contextual understanding of the topical evolution of data literacy in social and education sciences. As society becomes more data-driven, there is an increasing need for data literacy among citizens. And as data increasingly influences the societal, political, and cultural aspects of our lives, we observe a growing need for data literacy that leaves the confines of data science and statistical analytics and encompasses other disciplines (Bhargava et al., 2015; D'Ignazio, 2017; Gray et al., 2018; Van Audenhove et al., 2024). As Williamson et al. (2020) highlights, datafication in education—where data is used to assess and personalise learning and instruction—serves as an example of how data plays an increasingly central role in shaping educational practices. Alongside these developments, concepts like critical and creative data literacy have emerged, offering new interpretations of and pathways to engaging with data in meaningful ways (D'Ignazio, 2017; Louie et al., 2022). In this study, we focus on the topical evolution of data literacy in education and social science disciplines, such as communication, sociology, library and information studies, psychology, education, and pedagogy. We will identify which main topics and themes can be recognised, which topics carry the most research interest, as well as what trends can be identified. We will then provide a mapping of the development of data literacy research, contributing to a

clearer conceptual framework, focusing on the period from 2011 to 2023—starting from the year that relevant articles were published and included in the covered databases. Consequently, the study aims to answer the following research questions:

> RQ1: What is the topical evolution of data literacy in social and education science publications from 2011 to 2023?
>
> RQ2: What thematic trends can be identified in the topical evolution of data literacy (2011–2023)?
>
> RQ3: What main themes and topics are addressed in the publications on data literacy (2011–2023)?

In previous research, we defined three different fields within data literacy research, namely: the social sciences, open data, and STEM/education fields. The open data field, which focuses on making data freely available to enhance participatory democracy but recognises the need for data literacy among citizens; the STEM education field, which integrates data into curricula to teach students how to use and reflect on data, though it often emphasises usage over understanding; and the social sciences field, which examines the broader societal implications of data, promoting critical reflection on data's role in society (Van Audenhove et al., 2024). This is to be expected, as different disciplines and contexts require unique data competences, such as data interpretation for policy decisions, data literacy for fact-checking, data visualisation development, or using learning analytics to improve education. Other categorisations of data literacy are based on how different communities of practice define the concept. A good example is Ahmed et al. (2021), who conducted a study focused on three categories of communities of practice: education, fields and professions, and citizenship. Each community had a different understanding of the notion of data literacy.

Salomão Filho et al. (2023) conducted a systematic and narrative review of 39 articles that explore the educational and socio-political aspects of data literacy (2015–2021). The authors note the interdisciplinary nature of research on data literacy encompasses a wide range of topics and distinct aspects of data literacy, making it challenging to form a cohesive conceptual understanding. While we recognise that the interdisciplinary nature of the concept of data literacy makes it difficult to identify separate domains, we use the fields identified in Van Audenhove et al. (2024) as a conceptual starting point for understanding how data literacy is approached across different fields. Concretely, we focus on data literacy from educational and societal perspectives, with the education dataset focusing on data literacy within structured learning environments, such as curricula and pedagogical practices, while the social science dataset emphasises broader societal implications, including policymaking and civic engagement. This distinction allows us to analyse data literacy from educational and societal perspectives. Moreover, by treating "open data" as an interdisciplinary concept embedded in both fields, rather than as a separate field, we aim to provide a comprehensive review of how data literacy evolves across education and social sciences.

This study is structured as follows: (a) a methodology section outlining the approach used to select and analyse 210 articles, and (b) the results section, which provides a bibliometric analysis of the literature, an exploration of early definitions and the lack of consensus on data literacy, and a look at the thematic trends and concepts in the research. The review concludes with a summary of key findings, implications for future research, and the study's limitations.

2. Methodology

This study maps the topical evolution of the data literacy concept in the social and education sciences (2011–2023), identifying the main themes, evolutions of the concept, and gaps for future research. Since this is a topical analysis of one concept, a scoping review is a fitting methodology as it allows for a comprehensive mapping of the broader literature. For this, we made use of the methodological framework from Arksey and O'Malley (2005), combining this with the PRISMA guide for scoping reviews (Tricco et al., 2018). Following these guidelines, we first developed a research protocol (see the Supplementary File, Appendix 1, for the full research protocol).

We collected 391 articles from Web of Science (WoS) and Scopus databases between 2011 and 2023, mapping a 12-year span. Since we aimed to have a broad understanding of the concept and trace its evolution over time, we chose to start our analysis in 2011. This year marked the first significant mention of data literacy in education and social sciences journals, based on a preliminary review of the databases, capturing the period when data literacy began gaining prominence. We only included English, peer-reviewed, open- or early-access journal articles and book chapters in the field of social and education sciences. Review articles, proceedings, essays, and non-academic publications were not included. Due to accessibility, consistency, and resource constraints, we did not include non-English language sources, with the exception of translated sources. Our search string—("Data literac*") AND ("competence" OR "skills" OR "proficiency" OR "understanding" OR "use")—was too limiting, only giving 104 results starting in 2016. Accordingly, we broadened our search looking for papers containing "Data literac*." We placed no other restrictions on article selection. The search results were exported into Excel and duplicates were manually removed.

After applying our inclusion criteria and the removal of the duplicates (103 studies were duplicates), a selection of 288 studies' titles and abstracts was reviewed in-depth. Fifty-two studies were removed that did not mention data literacy in the title or abstract and did not address and/or lacked emphasis on data literacy competencies. Studies that fell outside of the education and social sciences were also excluded. Another 26 results were removed as they did not fit the formal article criteria (proceeding papers, reviews, etc.). After applying these criteria, 210 articles remained for analysis, as illustrated in Figure 1. The full research protocol in which all decisions are explained in detail can be found in the Supplementary File. The coding was conducted by the main author and checked by the secondary author. Cases where there was doubt were discussed amongst the author team and a decision was made.

The metadata from WoS and Scopus were exported in Excel, charting the following data: author(s), article title, abstract, publication year, source title (journal), author keywords, publisher, publisher's address, research areas, and DOI. For further analysis, several categories were added in new columns, namely "topic," "subtopic 1," "subtopic 2," "target group(s)/demographic," and "specific concepts."

As part of our mixed methods approach, we applied a quantitative frequency analysis using 4CAT Capture and Analysis Toolkit (Peeters & Hagen, 2021)—a tool for natural language processing—as well as a bibliometric analysis. The quantitative frequency analysis, after tokenising all the words, reviewed the word frequencies in titles and article abstracts allowing us to note the most common topics and chart their presence over a 12-year span. For the bibliometric analysis, we checked the main journals, authors, and their geographical distribution. This was followed by a qualitative analysis applying grounded theory with three

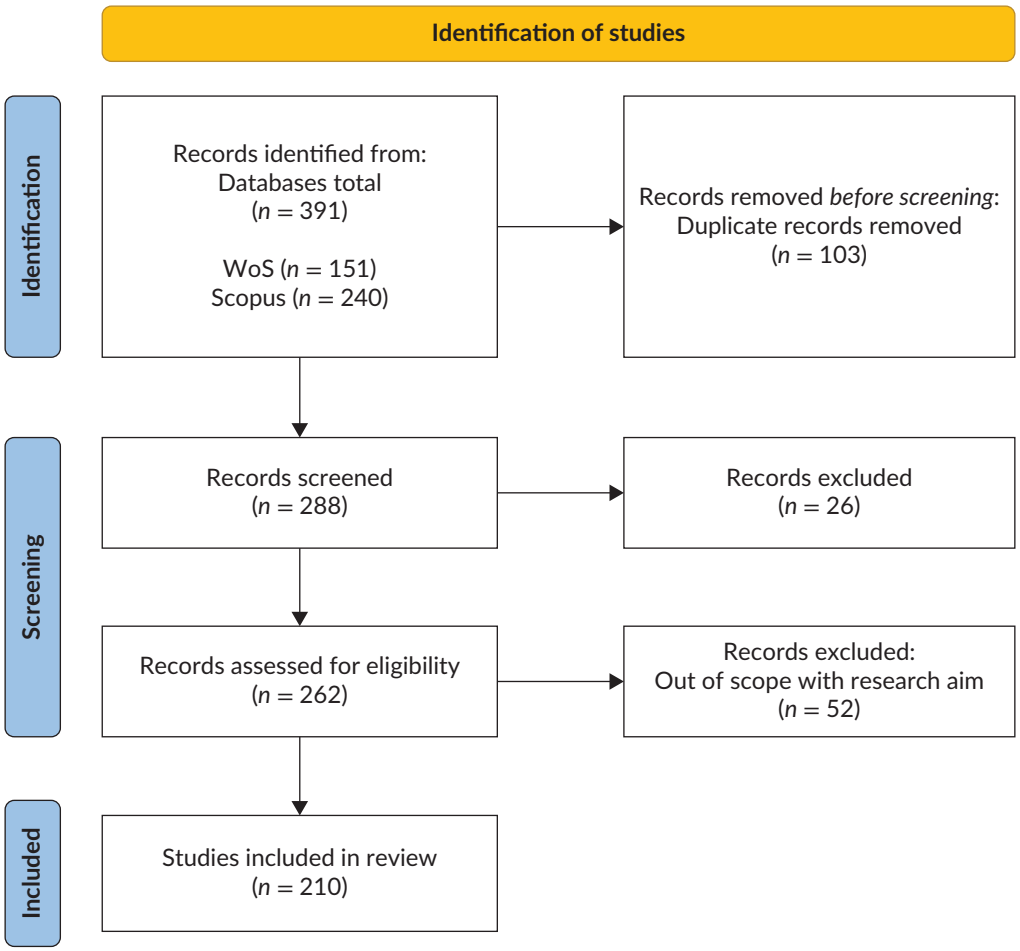

Figure 1. Prisma flowchart.

levels of thematic coding (open, axial, and selective; Glaser & Strauss, 1967; Strauss & Corbin, 1990). In this process, sensitising concepts were used, using the most frequent topics discovered through the word frequency analysis to guide our thematical coding process to allow for easier comparison at the end (Bowen, 2006). Concretely, the existing codes based on the quantitative analysis were used as inspiration during the analysis. However, room was allowed for an inductive approach to discover emerging themes and topics not captured by the quantitative analysis, leading to new codes (Bryman, 2016).

3. Discussion of Results

3.1. Bibliometric Analysis of the Literature

This section analyses the bibliometric data of the 210 selected articles. By examining the evolution of publications from 2011 to 2023, identifying the most prolific authors, and highlighting the journals with the highest frequency of publications, we aim to uncover trends in the academic discourse surrounding data literacy.

3.1.1. Evolution of the Number of Articles Published

During 2011–2023, we observe that the number of published articles on data literacy in social and education sciences (n = 210) has increased significantly (see Figure 2). The data reflects a general upward trend, with spikes in 2019, 2020 and 2023. This steady increase indicates a growing interest in and focus on data literacy within these fields over the years. Moreover, data literacy is starting to distinguish itself from other digital literacies. Despite the overall upward trend, we could attribute the dip in publications in 2021 to the possible impact of the Covid-19 pandemic, which provided challenging work circumstances for most sectors. The pandemic also influenced work performance in academia, with female academics especially experiencing a greater influence of the pandemic on their research productivity (Püttmann & Thomsen, 2024; see also Peetz et al., 2022; Sawert & Keil, 2021; Staniscuaski et al., 2021). The dip could also be attributed to academics shifting their research focus to Covid-19-related topics (Aristovnik et al., 2020; Liu et al., 2022; Roychowdhury et al., 2022), although this is hard to say definitively (Sohrabi et al., 2021). Overall, the broader trend implies a continuously growing interest in data literacy.

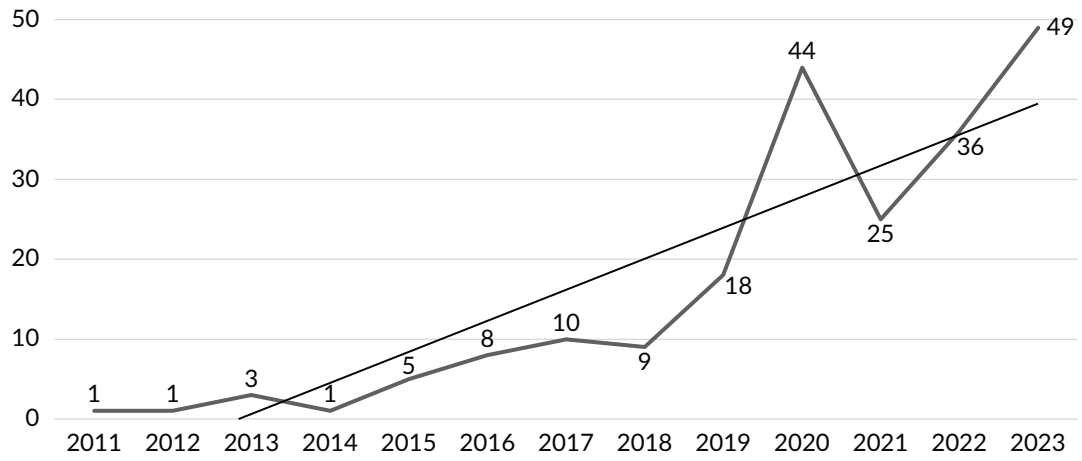

Figure 2. Evolution of number of publications per year (n = 210).

3.1.2. Most Occurring Journals

To gain an overview of the journals with the most publications (Figure 3), we conducted a bibliometric analysis of the journals (n = 135). Most articles were published in a 2020 special issue of the *Journal of Media Literacy Education*, the journal of the National Association for Media Literacy Education (n = 7, 5.18%). This was followed by the *Journal of Business and Finance Librarianship* (n = 6, 4.44%; Routledge, Taylor & Francis), of which five articles were published in 2020, and *Teaching and Teacher Education* (n = 6, 4.44%; Elsevier), which included publications ranging from 2015 to 2022. *Information and Learning Sciences* (Emerald Publishing) published five articles (3.7%). Two journals, *British Journal of Educational Technologies* (Wiley) and *Education and Information Technologies* (Springer), had four articles each (2.96%). Other journals had three or fewer publications on the topic.

Although a select number of journals had a slightly higher number of publications (Figure 3), the top-occurring journals had only a few articles published on data literacy. This indicates that the research on data literacy is spread across various disciplines and journals and is not concentrated in a single source, although we must

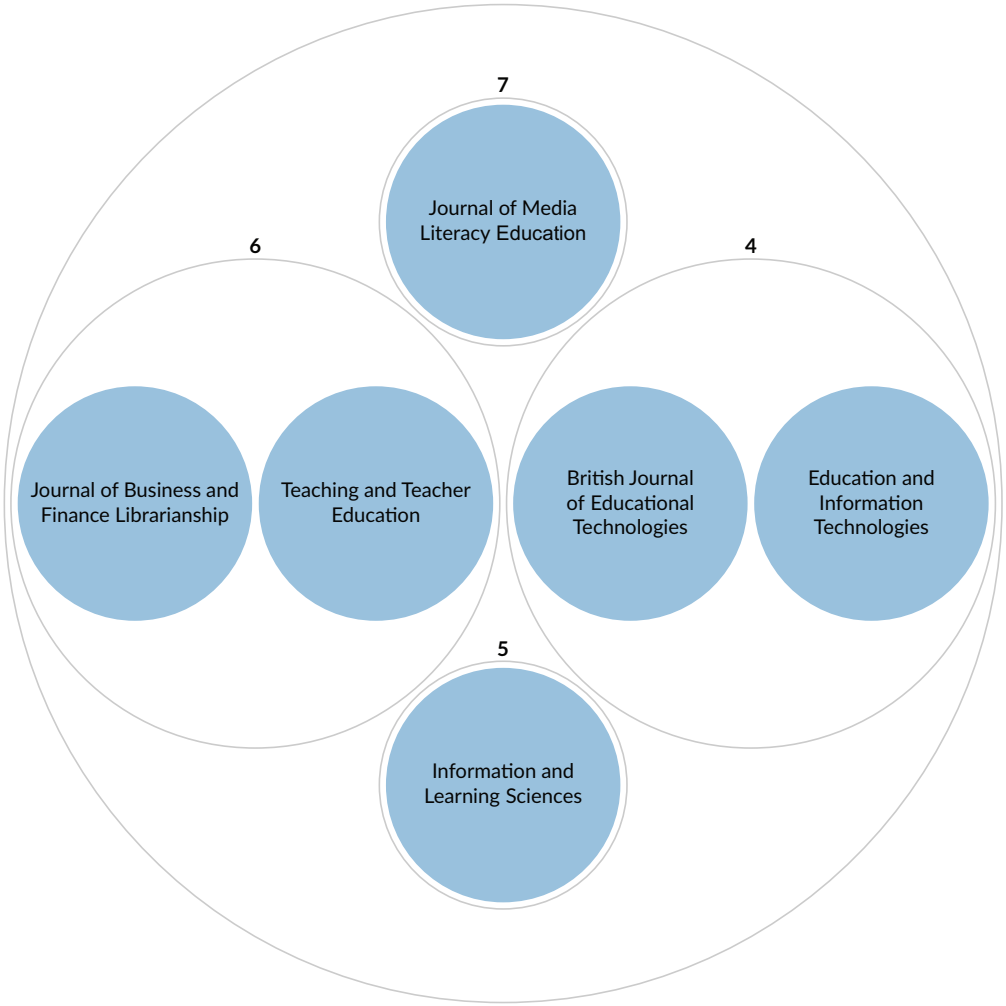

Figure 3. Top occurring journals ($n = 210$).

also consider that only open-access articles were selected for analysis. Overall, this shows that whilst research on data literacy is distributed across many journals, a few journals publish more data literacy-related content, with a notable peak in specialised publications around 2020.

3.1.3. Top Published Authors and Geographical Distribution

This subchapter provides an overview of the author diversity in the selected publications as well as the most prolific authors (Figure 4) and the geographical location of their most current research institution. We note that, in terms of author diversity, 575 authors are involved in the 210 publications. Fifty publications (23.8%) are single-authored contributions. The maximum number of authors in one publication is nine authors. Of the 210 publications, 433 authors (75.3%) are involved in only one, while 142 authors are involved in at least two. A few authors are more prolific in publishing research within the field of data literacy, with Raffaghelli J. E. ($n = 6$), Italy, and Shreiner T. L. ($n = 5$), US, standing out as the leading contributors. Beck J. S., US, and Cowie B., New Zealand, (co-)authored four papers. This was followed by Atenas J. (UK), Burress T. (US), Condon P. (US), Edwards F. (New Zealand), Havemann L. (UK), Koltay T. (Hungary), Mandinach E. B. (US), McGowan B. S. (US), Nguyen D. (The Netherlands), Reeves T. D. (US), and Whitesides H. (US) each (co-)authoring three papers.

Figure 4. Top occurring authors (n = 210).

The geographical distribution of top authors shows that they are all based in countries commonly referred to as the West, and primarily in the US.

3.2. Thematic Trends and Topical Distribution in Data Literacy Research

In this section, we aim to unpack the thematic trends within data literacy research, identifying key areas that have garnered attention and how these topics intersect. Through a word frequency analysis combined with inductive qualitative coding, we identified six main categories under which the diverse topics in data literacy research can be grouped: "teaching and student learning," "professional development and capacity building," "data use and knowledge-based decision making," "critical thinking and ethics," "research and analytical skills," and "engagement and society," although most topics are interconnected.

The word frequency analysis of the selected articles highlights the evolution of frequent topics in data literacy research (2011–2023), with Figure 5 visualising certain topical trends. It portrays an emerging and growing field, where earlier publications reflect broader discussions about data literacy. Within the field, there is a distinct interest in incorporating data literacy into education and training settings, though various

trends and understandings on how to go about this are observed. We also note a diversification of themes over time, such as an increasing frequency of "critical," "ethics," and "social," suggesting an emerging focus on a critical and ethical approach to data literacy, alongside analytical skills. The terms "professional" and "development" highlight a focus on building capacity for educators to effectively use, understand and teach data. The connections in the graph (Figure 5) suggest that data literacy is increasingly being explored beyond the central discussion around education. This shows the complex, nuanced field of data literacy with connected concepts and themes, showing the interconnections between categories. For instance, discussions on data-based decision-making frequently intersect with professional development and analytical skills. Nevertheless, the categorisation highlights a broad range of topics and a multifaceted field.

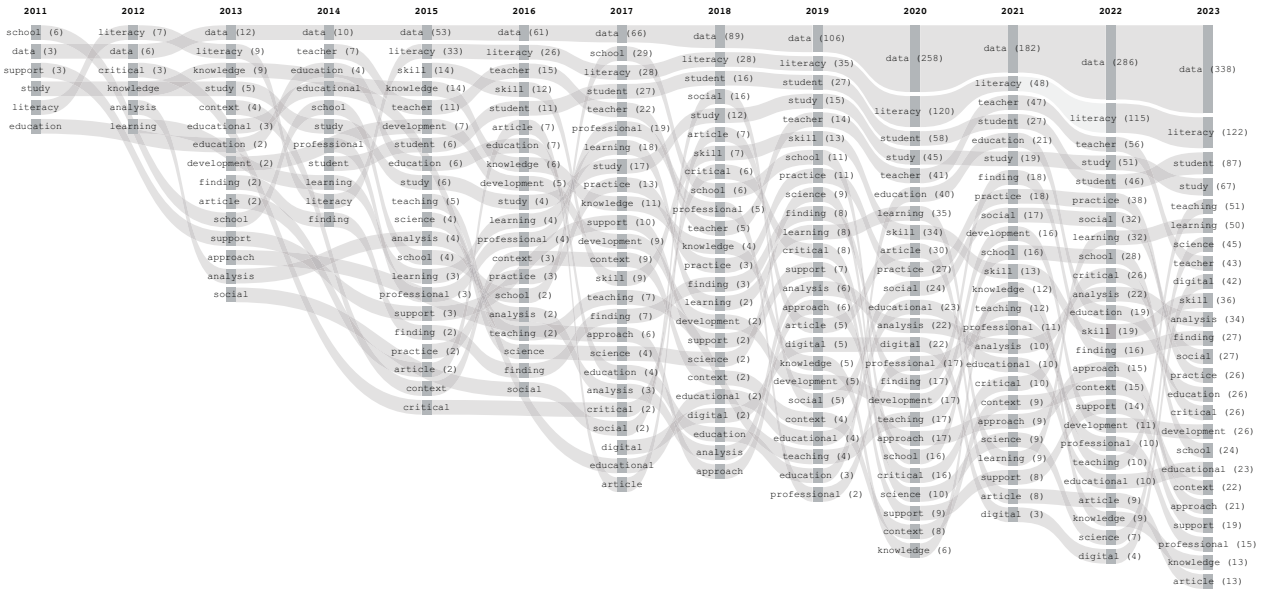

Figure 5. Evolution of 25 most occurring concepts ($n = 210$).

3.2.1. Demographic Focus in Data Literacy Publications

Regarding the addressed demographics in the selected publications, we observe that most articles discuss and research educational contexts, thus developing frameworks, interventions, and other for educators, students, and researchers. A significant portion of the content, programs, or discussions are focused on students in formal education settings. This includes various subcategories including but not limited to undergraduate students, graduate students, K-12 students, and secondary school students, with a particular emphasis on higher education. There is also a primary focus on educators and formal schooling, covering various types of teachers (preservice, novice, elementary, secondary, and tertiary education) and schools in general. This was an expected outcome due to the focus on social and education sciences. Still, the results reflect a broad focus on supporting teaching staff and improving educational settings and a significant focus on the professional development of (preservice) educators, although the focus of these articles mainly seems to remain on technical skills (Carey et al., 2018; Cowie & Cooper, 2017; Edwards et al., 2022). This is confirmed by the systematic literature review by Raffaghelli and Stewart (2020), who identified a strong focus on technical and operational skills within higher education, with the authors arguing for a critical approach to educators' data literacy development. Libraries and the role of librarians garner less focus. However, as the third most common category with a more specialised focus on enhancing the role of

libraries as educational support services, libraries are seen as essential in providing access to resources and supporting data literacy (Copeland et al., 2021; Pothier & Condon, 2020; Seidlmayer et al., 2020).

The focus on these three subgroups suggests a research gap for other target groups and sectors. Governments, civil society actors, and non-formal education lack representation in the selected literature. There is also less focus on the private sector and specific data professionals, although data literacy is crucial to work equitably and inclusively. Likewise, there is less attention on other demographics, such as older adults, parents, and vulnerable communities, although several articles define data literacy as a transversal and even lifelong skillset (Atenas et al., 2020; O'Neill, 2019; Seidlmayer et al., 2020).

3.2.2. Trends in the Selected Literature

Earlier publications concerning data literacy, such as Berendt (2012), Prado and Marzal (2013), and MacMillan (2015), focus on data literacy from an information perspective. For instance, Berendt (2012) defines data and privacy literacy as important sub-competences for information literacy. Data skills have frequently been discussed under the broader umbrella of information literacy, which includes the ability to navigate and use different types of information in a digital environment, encapsulating competences from computer, media, and data literacy (Bawden, 2001; Schield, 2004). Information literacy emphasises competences on searching for and assessing information, which are essential for understanding and using data (Berendt, 2012; Schield, 2004).

In addition, earlier publications primarily focused on the relevance of data use for development, for example using assessment data to inform instruction (Piro et al., 2014; Vanhoof et al., 2011). That said, there is a continuous interest in data-based decision-making and development, especially within the school context. Authors call for improved data literacy for teachers to handle and analyse assessment data to adapt their instruction and/or improve the school. These articles highlight the value of data-driven and evidence-based decision-making and tend to go hand in hand with calls for professional development and capacity building among educational staff (Bocala & Boudett, 2015; Conn et al., 2022; Cowie & Cooper, 2017; Hansen & Wasson, 2016; Luo et al., 2022; Piro et al., 2014). This is something Carey et al. (2018) refer to as "data-driven pedagogy." Yet, Whitesides and Beck (2020, p. 1) note that teachers are not data literate enough to "recognize inequitable data practices," allowing room for data bias in their teaching. Gibson et al. (2023, p. 1) find that "to expand students' data skills, educators must be grounded in a framework that holistically considers ethics, community impact, and science." In turn, we also find a focus on resource and support development for educators to effectively teach data literacy, such as introducing "colleague coaching" (Edwards et al., 2022).

Alongside this discussion, several authors also call for an updated education curriculum for students (Gehrke et al., 2021; Wilkerson et al., 2022), emphasising the importance of including data science and/or data-related practices, with a focus on statistical thinking, practical application, and inter-/multidisciplinary approach due to a cultural shift referred to as the "data culture" by Gould (2021). This could lead to improved student understanding and appreciation of the practical uses of statistics, preparing students to handle real-world scenarios (Bailey et al., 2020; Ow-Yeong et al., 2023; Watson & Smith, 2022). Adding to this, LaMar and Boaler (2021) reiterate the need for a curricula update to include "data science." The authors note that this empowers students by providing them with tools to analyse and understand the data they

encounter during their everyday lives whilst also stressing the importance of working with authentic, real-world data and being "critical consumers" of this data. Researchers emphasise hands-on, experiential learning approaches to build students' data literacy in practical and engaging ways (Cottone et al., 2023; Halliday, 2019; Kjelvik & Schultheis, 2020), but observe challenges in implementing data literacy education, such as curriculum constraints, disciplinary focus, and the need for resources (Ow-Yeong et al., 2023; Yoon & Copeland, 2020).

Especially after 2019, we find a growing attention for critical thinking, ethical data use, and civic participation. The increase in attention to critical thinking tends to go hand in hand with authors touching upon the importance of civic participation (or citizenship), bias in data, and transparency of data use (Gutiérrez, 2019; Heiser et al., 2023; McCosker, 2022; McCosker et al., 2022; Taylor et al., 2024; Whitesides & Beck, 2020). Markham (2019) observed critical thinking as crucial for data literacy, so that those who are data literate not only know how to use and critique data but are also able to take "social action." Sander (2020) argues for "critical big data literacy," focusing on awareness and reflection rather than data use. Whereas the understanding of the term can be inconsistent, "critical data literacy" is a concept mentioned in several abstracts, arguing that the traditional definitions of data literacy focus too much on data analytics and that the societal and participatory aspect is not considered sufficiently in models and frameworks.

The need for citizens to understand their data surroundings is not only mentioned by authors focusing on data science and statistics. There is a steady growth of articles focusing on citizen empowerment and awareness (Calabrese Barton et al., 2021; Carmi et al., 2020; Gebre, 2018; Pangrazio & Sefton-Green, 2020; Raffaghelli, 2020; Raffaghelli et al., 2024). A data-literate citizenry can create societal change, for instance by using open data for community development (Yoon & Copeland, 2020)—if the data is accessible and citizens have the necessary resources. For this, several authors call for working collaboratively with authentic, or real-world, data, for example developing climate change solutions by working with open data (Kuhn et al., 2023; see also Robertson & Tisdall, 2020; Palsa & Mertala, 2023; Werning, 2020). Open data is a growing concept within data literacy publications and often emerges as a subtheme within both education and social sciences, supporting our decision to treat it as an interdisciplinary concept rather than a distinct field. For instance, in education, open data is often integrated into discussions on data-driven learning, while in social sciences, it is connected to topics such as community engagement, accessibility, and transparency. Especially as of 2020, we observe a rise in publications that note its importance for data advocacy and societal change through data. Loría Solano et al. (2023) published a systematic literature review on open data literacy, noting a lack of open data literacy and a focus on technical skills in literature.

Carmi et al. (2020) refer to this as "data citizenship." Bhargava et al. (2022) find that data has become central to our democratic society, and to have influence means to understand data. They argue that traditional approaches to teaching data literacy, which often emphasise computational and statistical methods and skills, may not be sufficient to engage a broader and more diverse group of learners. To ensure wider participation and understanding in civic settings, it is necessary to rethink how data literacy is introduced and taught in schools, for example through data theatre and a focus on social justice (Bhargava et al., 2022), as there is a need for broader engagement. This echoes the discussion around critical data literacy. Data literacy education could benefit from embracing more interactive and creative learning techniques. Werning (2020) introduces the concept of making data "playable" by using elements of play and games to interpret real-world datasets. This approach aims to engage students in a more interactive and creative

way, contrasting with traditional and statistical methods that often focus heavily on visual evidence. By integrating other learning strategies, such as games, into data analysis, the article suggests a new approach to improving creative data literacy. This method encourages students to explore and interpret data in novel ways, potentially leading to deeper and more innovative understandings of data (Werning, 2020). This perspective complements ongoing discussions about broadening data literacy to encompass a wider range of skills and approaches and finding diverse ways to engage learners (Cottone et al., 2023; Sanei et al., 2024). Additionally, it allows for a wider range of individuals to connect with data, not only those who have a strong background in statistics and an interest in data analysis. This could foster a more inclusive learning environment that ensures all participants get to develop their data competences engagingly and meaningfully.

The last trend we wish to highlight is a continuous interest in data usage and (learning) analytics and data management (Ahmad et al., 2019; McGowan et al., 2023; Mosha & Ngulube, 2023; Robinson & Bawden, 2017; Vilar & Zabukovec, 2019). Within an information library and research context, articles on this topic tend to study how librarians and other data professionals can support students, researchers, and those in a data-rich environment in managing and analysing data (Condon & Pothier, 2022; Copeland et al., 2021; Giudice da Silva Cezar & Maçada, 2021). This is also referred to as "data librarianship" (Pothier & Condon, 2020), with libraries being considered valuable "information centres" (Seidlmayer et al., 2020) to support the community's data needs. MacMillan (2015) argues that librarians need to "expand" their skillset to be able to use and instruct about data resources, libraries being a valuable resource for individuals to gain the necessary data (research) skills. Likewise, public libraries are seen by users as important places for accessing data and for educational programs that teach data skills, especially in ways that are relevant to the local community. Therefore, libraries can adapt and build on this to meet the users' needs and tailor their data services to help users improve their data literacy (Copeland et al., 2021).

Libraries can play a significant role in helping communities access, understand, and use open data. Libraries and other information centres/organisations can serve as vital hubs for accessing, learning about, and using open data, and other types of user support. Thereby empowering individuals and communities to make informed decisions, support innovation, and engage more fully in civic life. The inclusive approach mentioned above aligns well with the role of public libraries and community centres as key spaces for accessing and learning about data. By adopting this approach, libraries can enhance their educational programs and data services, ensuring they are relevant and accessible to the local community and meet users' diverse needs.

3.2.3. Identification of Diverse Data Literacy Competences and Interpretations

Even in earlier publications on data literacy, authors referred to the importance of critical thinking (Berendt, 2012) and democratic education (Perrotta, 2013) in relation to data literacy, as well as linking it to information literacy (Perrotta, 2013; see also Berendt, 2012; Koltay, 2015; MacMillan, 2015). However, most articles primarily touched upon competences related to using, or more specifically, analysing data (Piro et al., 2014; Vanhoof et al., 2011). As of 2015, there are also mentions of science education, the alignment of data literacy and research, and the importance of finding (MacMillan, 2015) and managing one's data (Koltay, 2015, 2016). Mandinach and Gummer (2016, p. 366) lay out "the specific knowledge, skills, and dispositions teachers need to use data effectively and responsibly," calling for data literacy curricula integration. The integration of data literacy in curricula has been advocated by numerous authors over the

years. There remains a significant need across various countries to distinguish data literacy from media literacy and to integrate it into primary, secondary, higher, and adult education programs.

As of 2016, we observe the first mention of "data visualisations" in the selected literature. Philip et al. (2016) link the ability to interpret and develop data visualisations to civic participation. The article highlights a project that aimed to address the lack of data literacy in education by incorporating lessons on data collection, analysis, interpretation, representation, visualisation, and communication into a computer science class, emphasising the importance of understanding data in context. Specifically, data literacy needs to incorporate racial literacy, ensuring that students can examine race and power dynamics in data visualisations. This highlights the possible societal influence of data visualisations and narratives. Shreiner (2018, 2020) touches upon something similar, zooming in on the presence and purpose of data visualisations in social studies textbooks. We observe that in this context, data literacy involves more than just the technical skills to interpret and manage data and includes recognising how data might reinforce or challenge existing racial stereotypes and inequalities. It requires an understanding of the societal, political and cultural context, considering power dynamics, possible data risks, and the influence of data narratives (Donohoe & Costello, 2020; Kouts-Klemm, 2019; Mueller, 2022). Nonetheless, most articles in 2016–2017 remain focused on using data for development and data usage education (Reeves & Chiang, 2019; Stowell Bracke, 2017; van Geel et al., 2017). The earlier definitions of data literacy seem to primarily revolve around using data, specifically on data analytic skills and open dispositions, with a couple of outliers that influenced later conceptual discussions.

As of 2018, we see a steady increase of critical thinking and reflection-related competences addressed, as mentioned in Section 3.2.2. Moving beyond technical proficiency, several abstracts highlight how data education often focuses too narrowly on quantitative data skills, neglecting the broader understanding of data's role in everyday life (Gebre, 2018; Gray et al., 2018). For example, as Burns and Matthews (2018) argue, data literacy in journalism should extend beyond knowing how to work with data technically. It involves ethical, reflective, and critical thinking needed to authenticate, analyse, and communicate data wisely, effectively and responsibly. Authors recognise data as powerful tools for communication and advocate for a more nuanced and integrated approach to data literacy education that prepares individuals to navigate and critically engage with the data surrounding them and even influence the systems that produce and manage data (Gray et al., 2018). Data literacy is a form of influence and power. Therefore, a critical data citizenry would be able to navigate their data surroundings, hold data users accountable and advocate for their rights by demanding transparency and ethical data use (Dander & Macgilchrist, 2022; Fotopoulou, 2021; Hagen, 2022).

Carmi et al. (2020) emphasised the importance of developing data literacy initiatives that go beyond the individual, incorporate critical thinking about the online ecosystem, and empower citizens to be proactive. This perspective aligns with ongoing discussions about the need for more socially aware approaches to data literacy. As of 2020, this discussion on civic engagement and data literacy slowly but increasingly focuses on social justice and data risks and highlights power and accountability, although the focus remains on using data, though no longer merely for school improvement. Data literacy is currently seen as a potential instrument to promote social justice, although there is no unified approach (Raffaghelli, 2020). Nguyen and Beijnon (2024) highlight how critical data literacy can empower users to challenge and even resist the manipulative practices of big tech. Data literacy not only provides individuals with the tools to navigate

society but could also play a significant role in shaping activism, as well as personal and scientific inquiry. The need for transparency and the challenges posed by vague data practices echo the broader concerns about data literacy and power dynamics explored in other articles.

The gaps between the current state of data literacy education and the more comprehensive approaches advocated in the most recent literature are evident. While there is increasing awareness of the need to broaden data literacy to include socio-technical, ethical, and critical dimensions, much work remains to be done to integrate these elements into educational curricula and training. Interventions and educational projects often still emphasise data usage and less data understanding, especially when aimed at educators.

3.2.4. Shift in Focus Towards Societal Awareness and Engagement

The abovementioned topical evolution is similar to that of digital and media literacy. Early on, research on these literacies primarily focused on the proficiency to use digital technology and media systems, only later evolving to a more creative, active, and critical stance, combining competences that touch upon both using and understanding (Iordache et al., 2017; van Dijk, 2020). More recently, since the widespread use of social media, literature has been referencing "new media literacy," the definition adapting to the rise of, for instance, social media and information-seeking and sharing (Celik et al., 2021). The concept argues the importance of a critical outlook in an era of "new media technologies," providing a competence model that could allow users to recognise and deal with misinformation (Celik et al., 2021). This relates closely to the evolution of data literacy. A growing attention on "critical thinking," "awareness," and "citizenship" implies the growing importance of proactive, critical citizens who can navigate changes in the information society, such as the ever-growing influence of algorithms and AI.

Academics note that the previous definitions of data literacy, which were based on statistics and computational literacy, mainly focused on data analytics and data use for decision-making processes, leaving little room for critical analysis from sociology and community perspectives. Over the years this has evolved from a traditional data skills approach to models and definitions that also include critical thinking and data equity. Comparably, Mandinach and Gummer (2016) developed a data literacy framework for teachers, with the primary focus on data use for teaching improvement. However, in later publications, Mandinach and Jimerson (2021, p. 9) expand that data use is "at the heart of data ethics," educators need to carefully consider their actions regarding data usage, the methods they employ in their work, and how they focus their efforts on benefiting—rather than harming—the stakeholders involved. Atenas et al. (2023, p. 1) developed an "ethical framework" for data literacy in research, ensuring that their framework teaches an ethical approach to research data "to enable a critical understanding of the techno-centric environment and the intersecting hierarchies of power embedded in technology and data." These examples show an evolution from technical skills towards not only critical thinking, but also data ethics, although this trend remains relatively small, indicating a need for further exploration. The focus remains predominantly on data usage; however, considering a critical or community-focused perspective has become widespread.

4. Conclusion

In this study, we reviewed the state of data literacy research and the concept's topical evolution (2011–2023) by examining the main trends and topics. After selecting and coding 210 academic publications,

we found that the research on data literacy is ever-evolving. Similar to media literacy (Iordache et al., 2017), the concept of data literacy has grown increasingly complex, encompassing a wider range of competences over time. In response to the need for greater clarity and unity in the field, much of the research has focused on lesson interventions, educational projects, and the development and testing of models and frameworks for teaching data literacy. This goes hand in hand with the field recognising data literacy as a multifaceted, transversal skillset crucial for civic participation.

We observe that data literacy began to separate itself from information literacy and expanded beyond data science and statistics education to include the competences required to understand one's data surroundings and a critical mindset when it comes to using data (Gebre, 2018; Selwyn & Pangrazio, 2018). Research indicates that the challenge is not merely about teaching individuals to work with data but about equipping them with the skills and understanding to engage with data as informed individuals. This research field now evolves from a focus on individual data skills into data literacy for citizens capable of shaping a datafied society in ethical and socially responsible ways, thus moving from consumers to creators (Bhargava et al., 2022; Raffaghelli et al., 2024; Sander, 2024).

Similarly, most of the research published focuses on teaching technical data skills and learning analytics for development, albeit increasingly critical (Heiser et al., 2023; Mandinach & Jimerson, 2021). Attention for equitable data use and data misuse challenges also garners more attention in these areas, however, it needs to be emphasised that awareness is crucial for preventing the misuse of data and for fostering informed, responsible data use. This is increasingly studied within the school context and is even starting to be explored within the public sector (Clegg et al., 2023; Fotopoulou, 2021; Nguyen, 2023).

Although we observe an increase in critical thinking within data literacy publications, there is still room for research that touches upon the ethical use of data, specifically in the subfield of data justice and data advocacy. Particularly in community- and citizen-focused research, research could address the broader societal impacts of data-driven decisions. Libraries, as non-formal learning environments, are seen as valuable resources for skill development and data access as well as community engagement (Copeland et al., 2021; Seidlmayer et al., 2020). The influence of other information centres and civil society organisations on community development and citizen empowerment leaves room to be studied and possibly compared to or complement the role of libraries.

We also find a lack of attention to digital accessibility and inclusion in the research, even though there is an increase in agency-related topics, such as data justice, empowerment through data literacy, and data for equity. Therefore, further research is needed on data literacy in vulnerable communities and other understudied demographics. As argued in multiple publications, all individuals need to possess the necessary skills and knowledge to navigate a datafied society effectively. Accordingly, data literacy programs and resources should be designed with inclusivity and social support in mind. It is crucial that these programs not only focus on developing practical data usage but also address the potential dangers of data misuse and data risks (Atenas et al., 2023; Dodman et al., 2023; Mandinach & Jimerson, 2021), particularly within the private sector, which remains understudied.

This study also has its limitations. The scoping review identified key themes and knowledge gaps for future research; however, it mainly provides a surface-level overview based on the article titles and abstracts.

Due to this article providing a summary of the most notable trends in data literacy research, it remains quite descriptive, providing a synthesis of themes and patterns rather than certain nuances or complexities around data literacy. The variability of studies included in the research also made data analysis challenging. Scoping reviews, unlike systematic literature reviews, do not tend to include a quality check of the articles included nor an assessment of intervention effectiveness. To address these limitations, we only included peer-reviewed publications (2011–2023). Additionally, this review only covers open- and early-access English-language articles indexed in the WoS and Scopus databases, leaving room for future research to include other databases and national citation indexes. Our decision to focus on English-language articles was made for practical reasons, but we acknowledge the inherent language bias this introduces. To mitigate this limitation, we sourced articles from two international databases and employed both automated searches and manual screening. While these measures reduce the risk of algorithmic bias, we recognise that some degree of bias remains unavoidable. In addition, the scoping review provides a basis for more in-depth systematic literature reviews.

Research into specific concepts such as AI, algorithms, and privacy within the broader framework of data literacy is a topic for further research, as there was a lack of focus on it in the selected abstracts. Due to the growing interest in these topics, focus on social and education research might shift towards these topics' role in data literacy. This could also help to explore critical issues such as transparency and accountability in AI and algorithms. This is essential for understanding how data literacy intersects with various technological advancements and ethical concerns, further emphasising its societal relevance.

More research is required to foster a data literacy that is meaningful and applicable in real-world scenarios and engaging for all citizens, not merely those with an aptitude for statistics. This correlates with the need to have more effect and impact measurement research on the interventions and resources developed. Data literacy represents a dynamic paradigm, continually evolving as societal, technological, and educational contexts shift. Therefore, it needs to be tailored to address the varying levels of engagement and expertise of different demographics, as they encounter different needs and challenges. Similar to digital literacy, data literacy does not require a one-size-fits-all approach (Mensonides et al., 2024), but a nuanced and context-specific approach, providing a socially aware and adaptable data literacy that includes social support structures. This adaptability reflects the complex nature of the field, with new challenges and opportunities reshaping the approach to data literacy.

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Conflict of Interests

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Supplementary Material

Supplementary material for this article is available online in the format provided by the author (unedited).

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Digital Skills' Role in Intended and Unintended Exposure to Harmful Online Content Among European Adolescents

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Abstract

Digital skills play a crucial role in shaping adolescents' online experiences, serving both as a shield against harmful content and as a gateway to accessing it. Previous studies on online harmful content have predominantly focused on general exposure, overlooking the distinction between intended and unintended exposure (i.e., whether the adolescent deliberately sought out the content or was unexpectedly exposed to it). Moreover, existing studies did not consider the role of adolescents' digital skills. This exploratory study aims to newly examine the role of the subtypes of digital skills in the intended and unintended exposure to harmful online content among adolescents from four European countries, as well as the influence of protective and risky factors according to the problem behavior theory. Using multinomial logistic regression, a sample of 3,934 adolescents aged 12 to 17 (M = 14.4, SD = 1.3; 51% boys) from Estonia, Finland, Italy, and Poland was examined. The results show different associations with respect to the type of exposure. For instance, knowledge skills and technical/operational skills were found to be associated with unintentional exposure to harmful online content, but not with intentional exposure. Similarly, the protective role of the family was suggested in intentional exposure but not in unintentional exposure. These findings underscore the importance of raising awareness among educators and parents regarding the dual nature of digital skills. Rather than solely emphasizing their protective potential, we shall acknowledge and address the potential risks associated with certain facets of digital proficiency.

Keywords

adolescents; digital skills; harmful online content; intended exposure; risk factors; unintended exposure

1. Introduction

Nowadays, adolescents enter the online environment at an ever-younger age. This brings concerns about their safety in terms of their potential exposure to online risks (Livingstone & Helsper, 2010). These risks, which include a diverse set of intended and unintended experiences, may include encountering harmful online content (HOC; e.g., Livingstone & Haddon, 2008). HOC is defined as a wide range of content that depicts or promotes psychologically and physically harmful behaviors, attitudes, and experiences (Keipi et al., 2017). It is often encountered by adolescents; within the European context, 8–17% of adolescents stated that they were exposed to various types of harmful content online at least monthly (Smahel et al., 2020). According to current research, the exposure of adolescents to harmful content is associated with reduced subjective well-being and mental health issues (Hökby et al., 2016; Keipi et al., 2017; Mars et al., 2020), as well as involvement in risky activities in offline settings (Branley & Covey, 2017). Previous studies about HOC examined only general exposure, and they did not distinguish between intended and unintended exposure, nor did they consider the role of the adolescents' digital skills (e.g., Kvardova et al., 2021). This study is the first to investigate the role of digital skills related to adolescents' intended and unintended exposure to harmful online content (EHOC), while newly differentiating three dimensions of digital skills—technical and operational skills; communication and interaction skills; and knowledge skills—which could differ in their roles in EHOC. Further developing the problem behavior theory (Jessor, 2014), the study also explores the role of potentially risky factors (i.e., sensation seeking, low life satisfaction) and protective factors (i.e., social support from family, social support from friends). The study includes adolescents from four European countries—Estonia, Finland, Italy, and Poland.

2. HOC

Adolescence is marked by increased risk-taking behaviors, such as experimenting with illegal drugs and alcohol (Jackson et al., 2016). In our digital era, adolescents may encounter online content that depicts such risky behaviors, introducing them to digital risks (Livingstone & Helsper, 2010). Digital risks are defined as situations that may result in harm, either intentionally or unintentionally (Livingstone & Stoilova, 2021). Digital risks can take many forms, including EHOC in depictions of drug use, alcohol consumption, and unhealthy dieting. Such exposures have been linked to an increased risk of depression and self-harm (Hökby et al., 2016; Mars et al., 2020). These outcomes may not only result from such digital risk encounters but also act as predictors of further exposure to similar risks. Moreover, digital risks are increasingly recognized for their potential to negatively affect young people's mental well-being (Mascheroni et al., 2020).

Concerns about adolescents' online safety are therefore widely discussed (Haddon et al., 2020), as adolescents may lack the digital skills needed to properly assess HOC (Keipi et al., 2017). Online content related to drug use may include the disclosure of drug-related activities, guidelines for drug use, and debates about morality and legality (Costello et al., 2016). Online content that depicts alcohol consumption can contain personal descriptions of alcohol use and pictures of people drinking alcohol (Moreno et al., 2009), which often convey positive attitudes toward its consumption (Beullens & Schepers, 2013). Similarly, online content that depicts harmful and unhealthy eating may encourage adolescents to adopt unhealthy lifestyles. Such content may include pictures of ultra-thin bodies, the experiences of users with eating disorders, and tips for sustaining eating disorders (Ging & Garvey, 2018).

Notably, EHOC increases the likelihood of adolescents engaging in offline risky behaviors (Branley & Covey, 2017), which reinforces these activities as social norms (West et al., 2012). For example, adolescents may mimic behaviors like drug use after being exposed to online depictions, especially when endorsed by influencers (Motyka & Al-Imam, 2021). Similarly, content about alcohol can encourage offline drinking (Beullens & Vandenbosch, 2016). Moreover, social media's interactive nature can amplify peer-driven comparisons, leading to issues like disordered eating (Hummel & Smith, 2015). Overall, EHOC poses significant risks not only to adolescents' online experiences but also to their offline lives, including their mental health, as these risks may be intertwined with emotional problems (Mascheroni et al., 2020).

3. Intended and Unintended EHOC

Our study employs the CO:RE classification of online risk by Livingstone and Stoilova (2021), which views online risk as arising from the interaction between a child's agency and the digital environment, including algorithms. This classification outlines four dimensions of risk: content, contact, conduct, and contract. Since we focus on HOC in our study, we are exploring a form of content risk that may be viewed either unintentionally or intentionally. Unintentional exposure occurs when adolescents stumble upon HOC, such as explicit, violent, age-restricted material or content, that promotes dangerous behaviors, like drug abuse or anorexia (Răcătău, 2013). Intentional exposure may, on the other hand, involve purposefully seeking out harmful materials, such as searching for extreme diet tips, pornographic material, or types of illegal drugs. This study differentiates between unintentional and intentional EHOC, unlike previous studies (Kvardova et al., 2021), emphasizing the importance of understanding different influential factors.

4. Problem Behavior Theory: Protective and Risky Factors of Online Behavior

While risks arise from both online and offline contexts, their presence does not guarantee harm or a uniform impact on all adolescents (Livingstone, 2013). Some of them, labeled as "vulnerable" (Sonck & de Haan, 2013), may face heightened risks and harm online, which is influenced by individual and social factors like parent–child relationships (Livingstone, 2010). Problem behavior theory (Jessor, 2014) posits social support (e.g., family, friends) as a protective deterrent to risky behavior, while risk factors amplify engagement in problematic actions through models and opportunities (Jessor et al., 2003). Recent studies successfully extended this theory to online behaviors (Kvardova et al., 2021). Our study focuses on potential risky (i.e., low life satisfaction, sensation seeking) and protective (i.e., family and friend support) factors that influence adolescents' EHOC. It is important to note that our study is based on cross-sectional data and, as such, we cannot infer the directionality of the observed associations.

4.1. Protective Factors of Online Risks and HOC

According to theoretical propositions, it seems that similar online activities and online risks are clustered, and the same risky and protective factors (i.e., variables) can impact the cluster of online risks in similar ways (Smahel et al., 2022). Therefore, in this section, we look at the important variables that serve as protective factors for different online risks and HOC.

4.1.1. Role of Family Support

Adolescence is a period when the family is a key protective factor against risky behaviors, both offline and online (Loke & Mak, 2013). Parental support, marked by warmth and involvement, aids the smooth transition from childhood to adulthood (Newland, 2014). Conversely, a lack of support escalates the chances for risky behaviors (Becoña et al., 2012). Family support is pivotal in deterring harmful actions, including EHOC (Livingstone & Smith, 2014). Supportive practices, such as parental mediation, a process through which parents guide and regulate their children's media use, are one of the key protective strategies in ensuring safer digital use (Livingstone & Helsper, 2008). This is particularly effective in helping children understand and critically evaluate the content they encounter (Livingstone & Helsper, 2008), including HOC. Family support can help children navigate online environments more safely, reducing their exposure to risky content. Previous studies have also shown that individual risk factors for EHOC can be mitigated by a positive family environment (Kvardova et al., 2021).

4.1.2. Role of Friend Support

The transition to adolescence reshapes youths' social networks, with peers becoming vital support (Brown & Larson, 2009). Cooperative skills and diverse perspectives develop through peer interactions (Molleman et al., 2022). Adolescents discuss online experiences, seek advice, and shape digital conduct with friends (Wolak et al., 2006). Supportive relationships with friends may therefore play a protective role against offline and online risky experiences (Wolak et al., 2006). However, previous studies (Molleman et al., 2022) suggested that peer influence may be a double-edged sword: It can prompt rule compliance and promote pro-sociality, but it can also provoke rule violations and reduce pro-sociality. Relatedly, previous research on EHOC (Kvardova et al., 2021) indicated the importance of friends' negative influence, with friend support emerging as a risk factor. It is thus essential to examine the role of friend support more closely by distinguishing between intentional and unintentional EHOC.

4.2. Risky Factors of Online Risks and HOC

4.2.1. Role of Sensation Seeking

Sensation seeking is a personal trait defined by a thirst for novelty and adventure, and a general willingness to undertake risks (Pikó & Pinczés, 2019). Unlike curiosity, which drives intellectual exploration and learning, sensation seeking often leads to engagement in risky behaviors with potential negative consequences. There is a risk factor to engaging in various risky situations, like the abuse of alcohol (Lac & Donaldson, 2021). It has been shown that sensation seekers tend to take more risks, both in offline and online environments. The internet, in particular, provides numerous opportunities for adolescents to experiment with risky behavior (Livingstone & Smith, 2014). Even with no intention to encounter potentially harmful online content, sensation seekers tend to use the internet more frequently and often visit a variety of online spaces where such content can be found (Sheldon, 2012). Previous studies have shown that higher sensation seeking is associated with higher EHOC (Kvardova et al., 2021).

4.2.2. Role of Low Life Satisfaction

Life satisfaction, which is defined as one's perceived quality of life based on individual preferences across various areas (Henrich & Herschbach, 2000), tends to drop during adolescence, often reaching all-time lows (Gomez et al., 2013). It is a significant predictor of depressive disorders and suicidal thoughts (Park et al., 2005), and it is linked to adverse health behaviors (Valois et al., 2003). Adolescents with lower life satisfaction are more susceptible to online risks, like HOC, cyberhate, and violent extremism (Stoilova et al., 2021). This study focuses on whether low life satisfaction acts as a risk factor in EHOC.

5. Role of Digital Skills in EHOC

Given that all children are not similarly affected by the risks they encounter, it is particularly important to understand the role of digital skills (Haddon et al., 2020). Digital skills are defined as the ability to use information and communication technologies (ICTs) in ways that help achieve beneficial, high-quality outcomes in everyday life for individuals and others, while reducing potential harm associated with the more negative aspects of digital engagement (International Telecommunication Union, 2018). Digital skills are two-sided in terms of their implications because they come with both opportunities and risks (Mascheroni et al., 2020). The link between digital skills and online risk is not straightforward. Better skills are associated with more online opportunities, which are linked to more risk. Young people with higher levels of digital skills generally take advantage of more online opportunities and, as a result, spend more time online (Haddon et al., 2020). Hence, higher levels of digital skills are related to more exposure to risky and potentially harmful online content (Donoso et al., 2020). However, higher levels of digital skills were also shown to be associated with better achievement of positive outcomes and avoidance of negative consequences from internet use (van Deursen, 2020). It is likely that the harmful consequences of using the internet may be avoided by learning and improving specific digital skills (Sonck & de Haan, 2013).

The evidence suggests that the types of skills matter (Donoso et al., 2020). Research shows that digital skills are multidimensional and can be divided into various categories, each of which plays a unique role in navigating online risks and opportunities. For example, technical and operational skills (i.e., the ability to use devices, software, and networks effectively) are foundational for accessing online content and interacting with digital environments (Helsper et al., 2020). However, as previous studies (e.g., Carretero et al., 2017; Helsper et al., 2020) have pointed out, technical skills alone are insufficient to fully navigate the complexities of the digital world. Without additional critical and evaluative skills, technical competencies often lead to more passive engagement, resulting in exposure to online risks such as HOC (van Deursen & van Dijk, 2014).

Moreover, communication and interaction skills are essential for meaningful participation in online spaces, as they enable users to engage with others, share content, and express opinions while managing online relationships (Helsper et al., 2020). Strong communication skills help mitigate the risks associated with harmful online interactions, such as cyberbullying and exposure to inappropriate content, by equipping users with the tools to recognize, manage, and respond to online threats (Livingstone et al., 2016). Finally, knowledge skills are increasingly recognized as vital for navigating the digital environment, especially in relation to critically evaluating the credibility of online information and avoiding misinformation or harmful content (Helsper et al., 2020).

Even though previous research and frameworks, such as DigComp (e.g., Carretero et al., 2017), have acknowledged the need to differentiate between various digital skills, many studies still adopt a one-dimensional approach, focusing primarily on technical skills like software installation and device control (Helsper et al., 2020). As Helsper et al. (2020) note:

> Having just functional skills (understanding the functionalities of ICTs and being able to use them) is associated with more passive, consumptive participation in digital societies, while critical skills (understanding how and why technologies are designed and certain content is produced in particular ways) are essential for more active, constructive participation. (p. 15)

As a result, there is a lack of sufficient evidence that fully explores the broader range of digital skills.

In this study, we identify three types of digital skills that we believe are linked to EHOC: technical and operational skills; communication and interaction skills; and knowledge skills (Helsper et al., 2020). Technical and operational skills involve "the ability to manage and operate ICTs and the technical affordances of devices, platforms, and apps, from 'button' knowledge to settings management to programming" (Machackova et al., 2023, p. 8). Communication and interaction skills refer to "the ability to use different digital media and technological features to interact with others and build networks, as well as to critically evaluate the impact of interpersonal mediated communication and interactions on others" (Machackova et al., 2023, p. 9). Lastly, knowledge skills describe "the knowledge of the different aspects of internet-related properties (e.g., the functionality of hashtags)" (Machackova et al., 2023, p. 9). All these skills are part of the broader concept of digital literacy. The ySKILLS framework defines digital literacy as encompassing both functional digital skills and critical knowledge, which includes the understanding of the societal implications of digital technology and the ability to critically assess content (Smahel et al., 2023). While digital literacy is a broader construct, this study focuses specifically on the digital skills that adolescents may apply in relation to EHOC.

6. Control Variables

In addition to digital skills and the risk and protective factors on which this article focuses, previous research has identified additional variables that predict youth susceptibility to online risky behavior. Time spent online (Costello et al., 2016) and age (Sonck & de Haan, 2013) have been found to have positive associations with risky online encounters. For instance, older individuals spend more time online, visit more online platforms, and interact with more people online, thus being more likely to visit risky or harmful places (Oksanen et al., 2016). Similarly, gender may also play a role in exposure to potentially risky content. It has been shown that boys more frequently report looking at online content related to self-harm and suicide (Keipi et al., 2017) and at sexually explicit material (Peter & Valkenburg, 2006). Socio-economic status (SES) has also been found to be related to adolescents' EHOC (Notten & Nikken, 2014). On that basis, the analysis in the current study controlled for gender, age, SES, time spent online, and differences among countries.

7. Current Study

This exploratory study aims to shed light on the role of digital skills and selected risky and protective factors in the exposure of adolescents to HOC, both intended and unintended. Past research is broad in its conception of

digital skills and often lacks differentiation between sub-skill types (Haddon et al., 2020). Moreover, previous studies (e.g., Kvardova et al., 2021) did not distinguish between unintentional and intentional exposure to such content. The present study aims to fill this knowledge gap. It explores the following research questions (see Figure 1 for a graphical representation of the research questions):

> RQ1: What are the associations among three types of digital skills (i.e., technical and operational skills; communication and interaction skills; and knowledge skills) and intentional online harmful content exposure, while considering the role of risk factors (i.e., low life satisfaction, sensation seeking) and protective factors (i.e., social support from family, social support from friends)?

> RQ2: What are the associations among three types of digital skills (i.e., technical and operational skills; communication and interaction skills; and knowledge skills) and unintentional online harmful content exposure, while considering the role of risk factors (i.e., low life satisfaction, sensation seeking) and protective factors (i.e., social support from family, social support from friends)?

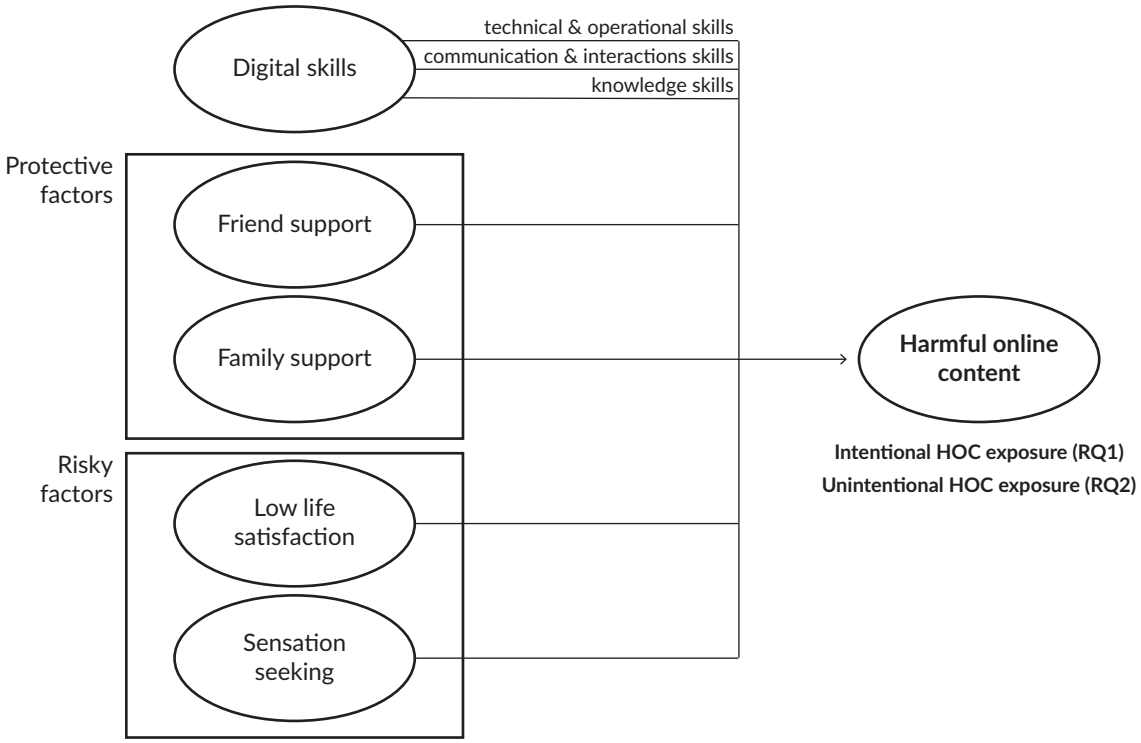

Figure 1. Graphic display of research questions.

8. Methods

8.1. Sample

The current study utilized data from the ySKILLS project. The sample encompasses 3,934 Estonian, Finnish, Italian, and Polish adolescents aged 12 to 17 (M = 14.4, SD = 1.3; 51% boys). Individual samples included 1,221 adolescents from Estonia (age: M = 14.97, SD = 1.22; 50.6% girls), 713 from Finland (age: M = 13.95, SD = 1.07; 52.7% girls), 943 from Italy (age: M = 14.03, SD = 1.24; 58.2% boys), and 1,057 from Poland (age:

$M = 14.18$, $SD = 1.35$; 51.6% girls). For the purpose of this study, these four countries were selected because they all included the risk-related questions we focus on in our study. For more information about the country sampling, see Machackova et al. (2024) and Machackova et al. (2023).

8.2. Procedures

Data were collected between April and December 2021 in Estonian, Finnish, Italian, and Polish schools. The schools were selected based on their SES to ensure diversity. Convenience sampling was used. Computer-assisted online questionnaires were completed by the children in school computer classrooms or at home during distance learning. To address translation quality and ensure equivalence in meaning across the countries, members of the ySKILLS team in each of the participating countries coordinated and supervised the translation of the questionnaire. This process included two phases of cognitive testing to assess the participants' understanding of the questions. The initial phase, conducted in August and September 2020 with 60 participants across six countries, focused on evaluating the youths' comprehension of question wording, examples, and digital skills items. Based on this feedback, the questionnaire was revised and tested again in January and February 2021 with 37 youth participants, including 12 from the youngest age group who also evaluated the length of the questionnaire. These two rounds of testing helped confirm that the questions were clear and consistent in meaning across the translations (Machackova et al., 2024). The research has been approved by institutional review boards in each participating country. Informed consent (active or passive) from the children and their legal guardians was obtained prior to the administration of the questionnaires. Adolescents were assured anonymity and given the option to respond with "I prefer not to say" or "I don't know/I do not understand what you mean by this" for each question. For more details about the data collection, see Machackova et al. (2024) and Machackova et al. (2023).

8.3. Measures

In terms of EHOC, we distinguished between intended and unintended exposure. Intended exposure is when the adolescent looked for the content or expected to receive it from somebody else. Unintended exposure is when the adolescent did not look for the content or did not expect to receive it or encounter it, yet still saw it. Adolescents were given the following instruction:

> On the internet, you may also encounter content (texts, images, videos) that is not healthy or that can be harmful. This includes content about taking drugs, alcohol, harmful and unhealthy dieting or eating, or other behavior which can be harmful for your health.

Subsequently, they were asked if they had seen something like that content online or on a phone in the past year (yes or no); and how often they had seen something like that when they intended/did not intend to see it: "How often have you seen something like this when you INTENDED to see it?"; "How often have you seen something like this when you DID NOT INTEND to see it?" Respondents answered on a scale that ranged from 1 (*never*) to 6 (*daily or almost daily*).

Digital skills were sorted into three dimensions: technical and operational skills; communication and interaction skills; and knowledge skills. They are based on how Helsper et al. (2020) conceptualized these dimensions within the youth Digital Skills Indicator (yDSI).

Technical and operational skills were assessed with the following:

> Please indicate how true the following six statements are of you when thinking about how you use the internet and technologies such as mobile phones or computers (e.g., I know how to adjust privacy settings; I know how to turn off the location settings on mobile devices).

Adolescents were asked to respond on a scale that ranged from 1 (*not at all true of me*) to 5 (*very true of me*). The internal consistency was $\omega = 0.75$.

Communication and interaction skills were assessed with the following:

> Please indicate how true the following six statements are of you when thinking about how you use the internet and technologies such as mobile phones or computers (e.g., I know when I should mute myself or disable video in online interactions; I know how to report negative content relating to me or a group to which I belong).

Adolescents responded on a scale that ranged from 1 (*not at all true of me*) to 5 (*very true of me*). The internal consistency was $\omega = 0.76$.

Knowledge skills were assessed with the following:

> To what extent are the following six statements about technologies such as the internet and mobile phones true or not true? (e.g., The first search result is always the best information source; Whether I like or share a post can have a negative impact on others; Using hashtags # increases the visibility of a post).

Adolescents were asked to respond on a scale that ranged from 1 (*definitely not true*) to 3 (*definitely true*). The internal consistency was $\omega = 0.42$, possibly because different items covered different online situations and may not always apply. This is further discussed in the Limitations section.

Sensation seeking was measured with the Brief Sensation Seeking Scale (Hoyle et al., 2002). Adolescents reported how strongly they agreed or disagreed with four statements (e.g., I would like to explore strange places; I like to do frightening things) on a scale that ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). The internal consistency was $\omega = 0.75$.

Life satisfaction was measured with the Short Depression–Happiness Scale (Joseph et al., 2004). Adolescents were asked how true six statements were about themselves in the past year (e.g., I felt happy; I felt pleased with the way I am; I felt that life is enjoyable). They were asked to respond on a scale that ranged from 1 (*never*) to 4 (*often*). The internal consistency of the scale was $\omega = 0.79$.

Family support was measured with three items that asked about family support (i.e., When I speak someone listens to what I say; My family really tries to help me) and feeling safe (i.e., I feel safe at home). The first item was adapted from the Health Behavior in School-Aged Children survey (WHO, 2016); the second item was drawn from the Multidimensional Scale of Perceived Social Support (Zimet et al., 2010); and the third

item was developed for the EU Kids Online Survey. Participants reported the extent to which these three statements were true on a scale that ranged from 1 (*not true*) to 4 (*very true*). The internal consistency of the scale was $\omega = 0.76$.

Friend support was assessed with three items from the Friends Subscale of the Multidimensional Scale of Perceived Social Support (Zimet et al., 2010). Adolescents rated how truthful the following three statements were: "My friends really try to help me"; "I can count on my friends when things go wrong"; and "I can talk about my problems with my friends." Participants responded on a scale that ranged from 1 (*not true*) to 4 (*very true*). The internal consistency was $\omega = 0.85$.

Time spent online was measured with the following question: "About how long do you spend on the internet during a regular weekday (i.e., school day)?" Answers ranged from 1 (*little or no time*) to 9 (*about 7 hours or more*).

SES was assessed with the following question: "Which of the following best describes your financial situation and that of the people with whom you live?" (Centrum Badania Opinii Społecznej, 2014). Answers ranged from 1 (*we live very well – we can purchase luxury items and still have money left over*) to 5 (*we struggle to get by – we sometimes do not have enough money to afford basic needs, such as food and clothes*).

8.4. Analysis

We conducted a multinomial logistic regression. Two models were created: one for intentional EHOC and another for unintentional EHOC. Before running the models, we checked for multicollinearity, assessed residuals' independence, and tested linearity using the Box-Tidwell Test. Linearity assumptions were violated for SES, friend support, and low life satisfaction in the intentional exposure model, and for sensation seeking in the unintentional exposure model. Quadratic terms were included in these models to explore potential curvilinear relationships.

9. Results

9.1. Missing Data

Regarding the occurrence of missing values in the dependent variables, 28.2% of the values were missing for intentional EHOC and 27.5% for unintentional EHOC. This pattern suggests that the missingness may not be entirely random but may be potentially influenced by the sensitive nature of EHOC, where respondents might have chosen not to answer specific questions. Further details on how missing data was categorized and managed in this dataset can be found in Machackova et al. (2024), where each missing value type is coded and the implications are discussed comprehensively. The occurrence of missing values is further discussed in the Limitations section.

9.2. Descriptive Statistics and Data Transformation

We transformed the dependent variables for our models (i.e., intentional EHOC; unintentional EHOC) into three frequency categories: never; rarely; at least monthly. The "rarely" category consisted of the options: once; a few times. The "at least monthly" category included the options: at least every month; at least every

week; daily or almost daily. We did this to distinguish no exposure from non-frequent and high exposure in order to keep a solid number of respondents in each category for the analysis. As for the sub-dimensions of digital skills, we calculated the proportion of skills at a high level by dividing the high-skill score by the number of items in the given dimension (Helsper et al., 2020). The digital skill scale was scored with a value of zero to one. Descriptive statistics for the continuous variables are listed in Table 1. The full model results are listed in Tables 2 and 3.

Table 1. Descriptive statistics of continuous variables.

	M	*SD*	Min	Max
Age (years)	14.35	1.30	12	17
SES	2.20	0.64	1	5
Time spent online	6.09	1.92	1	9
Family support	3.50	0.61	1	4
Friend support	3.22	0.75	1	4
Sensation seeking	3.21	0.92	1	5
Low life satisfaction	2.49	0.84	1	4
Technical and operational skills	0.56	0.31	0	1
Communication and interaction skills	0.64	0.30	0	1
Knowledge skills	0.50	0.25	0	1

Notes: For the variable Low life satisfaction, higher scores indicate a higher degree of low life satisfaction (i.e., lower overall life satisfaction); the model with the dependent variable set to intentional exposure has a significantly better fit than the null model ($\chi^2(28) = 323.34$, $p < .001$, Nagelkerke $R^2 = .20$).

Table 2. Intentional EHOC (RQ1).

	Never vs. Rarely				Never vs. At Least Monthly			
			95% CI				95% CI	
	b	OR	LL	UL	*b*	OR	LL	UL
Intercept	−0.23	—	—	—	−1.82***	—	—	—
Age	0.23***	1.25	1.13	1.38	0.25***	1.28	1.11	1.49
Gender	−0.08	0.92	0.71	1.21	0.10	1.11	0.75	1.65
SES	−0.02	0.98	0.80	1.19	−0.03	0.97	0.75	1.27
SES ²	0.09	1.09	0.92	1.30	0.26*	1.29	1.05	1.58
Time spent online	0.08*	1.09	1.01	1.17	0.24***	1.27	1.14	1.41
Friend support	−0.09	0.92	0.74	1.14	0.12	1.13	0.82	1.56
Friend support ²	−0.29**	0.75	0.61	0.92	−0.08	0.93	0.71	1.21
Family support	−0.10	0.90	0.71	1.15	−0.42**	0.66	0.48	0.90
Sensation seeking	0.68***	1.98	1.70	2.30	0.72***	2.06	1.64	2.58
Low life satisfaction	0.39***	1.48	1.24	1.77	0.36**	1.44	1.11	1.87
Low life satisfaction ²	−0.22*	0.81	0.68	0.96	−0.17	0.85	0.66	1.09
Technical and operational skills	0.25	1.28	0.77	2.13	0.14	1.15	0.55	2.41
Communication and interaction skills	−0.28	0.76	0.45	1.28	−0.28	0.76	0.35	1.63
Knowledge skills	0.36	1.44	0.84	2.46	0.13	1.14	0.52	2.51

Table 2. (Cont.) Intentional EHOC (RQ1).

	Never vs. Rarely				Never vs. At Least Monthly			
			95% CI				95% CI	
	b	OR	LL	UL	*b*	OR	LL	UL
Finland	−0.26	0.77	0.51	1.16	0.07	1.08	0.56	2.07
Italy	−0.01	1.01	0.72	1.41	0.27	1.31	0.77	2.23
Poland	−0.63***	0.53	0.37	0.77	−1.06***	0.35	0.21	0.57

Notes: $N = 1{,}809$; *b* = unstandardized regression coefficient; OR = odds ratio; LL = lower level; UL = upper level; * $p < .050$, ** $p < .010$, *** $p < .001$; the reference category is Never; the reference country is Estonia; Gender 0 = boys, 1 = girls.; for the variable Low life satisfaction, higher scores indicate a higher degree of low life satisfaction (i.e., lower overall life satisfaction); variables with a superscript ² indicate their quadratic (curvilinear) transformations included in the analysis to capture non-linear effects; the model with the dependent variable set to unintended exposure outperforms the null model ($\chi^2(28) = 326.65$, $p < .001$, Nagelkerke $R^2 = .19$).

Table 3. Unintentional EHOC (RQ2).

	Never vs. Rarely				Never vs. At Least Monthly			
			95% CI				95% CI	
	b	OR	LL	UL	b	OR	LL	UL
Intercept	−0.11	—	—	—	−0.80	—	—	—
Age	0.19***	1.21	1.10	1.32	0.13*	1.14	1.01	1.29
Gender	−0.62***	0.54	0.42	0.68	−0.88***	0.41	0.30	0.57
SES	0.18*	1.20	1.00	1.43	0.25*	1.29	1.02	1.62
Time spent online	0.07*	1.07	1.00	1.14	0.14**	1.15	1.05	1.25
Friend support	−0.07	0.94	0.79	1.12	−0.16	0.85	0.68	1.06
Family support	0.14	1.15	0.92	1.44	0.13	1.14	0.86	1.52
Sensation seeking	0.35***	1.43	1.25	1.62	0.47***	1.60	1.32	1.94
Sensation seeking ²	−0.13*	0.88	0.79	0.99	−0.21**	0.81	0.68	0.97
Low life satisfaction	0.29***	1.33	1.14	1.56	0.50***	1.65	1.34	2.04
Technical and operational skills	0.49*	1.63	1.03	2.57	0.45	1.58	0.85	2.92
Communication and interaction skills	−0.30	0.74	0.46	1.18	−0.24	0.78	0.41	1.48
Knowledge skills	1.34***	3.83	2.33	6.28	1.90***	6.66	3.39	13.08
Finland	0.58**	1.79	1.24	2.61	0.36	1.43	0.88	2.33
Italy	−0.01	0.99	0.73	1.34	0.02	1.02	0.67	1.55
Poland	−0.33*	0.72	0.52	1.00	−0.30	0.74	0.48	1.15

Notes: $N = 1{,}831$; *b* = unstandardized regression coefficient; OR = odds ratio; LL = lower level; UL = upper level; * $p < .050$, ** $p < .010$, *** $p < .001$; the reference category is Never; the reference country is Estonia; Gender 0 = boys, 1 = girls; for the variable Low life satisfaction, higher scores indicate a higher degree of low life satisfaction (i.e., lower overall life satisfaction); variables with a superscript ² indicate their quadratic (curvilinear) transformations included in the analysis to capture non-linear effects.

9.3. Digital Skills

None of the three types of digital skills were significant in relation to intentional EHOC. Regarding unintentional exposure, two significant relationships were supported, namely for technical and operational skills, and knowledge skills. The likelihood of rare unintentional EHOC increases 1.6 times with higher

technical and operational skills in adolescents (odds ratio [OR] = 1.63). As for knowledge skills, the likelihood of rare unintentional EHOC increases almost 4 times when adolescents have higher knowledge skills (OR = 3.83). Similarly, with higher knowledge skills, an adolescent's likelihood of more frequent (at least monthly) unintentional EHOC increases 6.7 times (OR = 6.66). Thus, for knowledge skills, there was a significant difference between rare exposure and more frequent (at least monthly) exposure (i.e., the effect of knowledge skills increases with higher frequency of unintentional EHOC).

9.4. Protective Factors

Regarding family support, it did not show a significant relationship with rare intentional EHOC. However, for more frequent (at least monthly) intentional exposure, a noteworthy finding emerged. Adolescents with higher family support are nearly 1.5 times less likely to experience such exposure (OR = 0.66).

In the case of friend support, a curvilinear relationship was significant for the rare intentional EHOC. This finding implies that lower friend support is associated with a lower risk for rare intentional EHOC.

9.5. Risky Factors

Higher sensation seeking in adolescents is associated with a higher likelihood of rare (OR = 1.98) and more frequent (at least monthly; OR = 2.06) intentional exposure. As for unintended exposure, a significant curvilinear relationship exists for both frequency categories. With higher sensation seeking in adolescents, the likelihood of unintended EHOC increases; however, for those who score at the highest level of sensation seeking, the likelihood does not increase anymore.

Regarding rare intentional exposure, a significant curvilinear relationship was found. As for unintentional exposure, the likelihood of rare unintentional EHOC increases 1.3 times with lower life satisfaction in adolescents (OR = 1.33). The likelihood of more frequent (at least monthly) unintentional EHOC also increases with lower life satisfaction among adolescents, by 1.6 times (OR = 1.65). Thus, there is a slight increase in the influence of this factor with more frequent (at least monthly) unintentional EHOC.

10. Discussion

10.1. Role of Digital Skills

Regarding the association of digital skills to intentional EHOC, no relationship was supported for any of the three types of examined skills. We can speculate that searching for such content is so simple that it does not require the use of enhanced digital skills.

Our study revealed that higher technical and operational skills are associated with a greater likelihood of rare unintentional EHOC. These skills, involving the management and use of ICTs and the technical aspects of devices, platforms, and applications (Helsper et al., 2020), offer adolescents wider access to online content. Consequently, more skilled adolescents who explore the internet extensively may have an increased risk of encountering harmful content (Donoso et al., 2020). Similarly, higher knowledge skills were associated with a heightened likelihood of unintentional EHOC, with a more pronounced effect at higher exposure frequencies.

This suggests that possessing the theoretical knowledge for using ICTs may not effectively shield adolescents from practical risky encounters. Moreover, having the skills to avoid online risks does not necessarily mean that adolescents actively employ them for protection. It is also important to consider that negative online experiences, including unintentional EHOC, may themselves lead to an increase in adolescents' knowledge of online harms. This suggests a potential bidirectional relationship, where exposure to such content enhances the awareness of risks. In contrast, communication and interaction skills showed no significant relationship, implying that the ability to interact with other users and communities may enhance intentional exposure experiences but it does not directly correlate with an increased likelihood of EHOC.

10.2. Role of Protective Factors

In our research, we prove that it is possible to use Jessor's theory in the context of adolescents' online behavior. Family support has been shown to act as a protective factor in more frequent intentional EHOC (i.e., it reduces the likelihood of such exposure). This result is in line with the findings of previous studies (e.g., Chng et al., 2015; Cho & Cheon, 2005) that have examined the protective effect of the family against adolescents' online risky behaviors. In cohesive families, parents' moral authority and influence dissuade engagement with harmful content (Cho & Cheon, 2005). Lower friend support was associated with lower rare intentional EHOC, which reflects the influence of social networks on adolescent risk-taking (Gardner & Steinberg, 2005). Adolescents may adopt harmful content to conform to peer behavior, mirroring friends' conduct (Jessor, 1987). Reduced friend support may decrease intentional exposure, suggesting its role as a potential risk factor for EHOC (Kvardova et al., 2021). However, no such relationship was found for more frequent intentional exposure, underscoring the enduring importance of family support at higher exposure rates.

Our study did not find any relationship between friend and family support and unintentional EHOC. While both friends and family influence conscious decisions, especially at a moral level (Cho & Cheon, 2005), their impact on unintended actions is limited. To mitigate unintentional exposure to risky content, families often use parental mediation, including restrictive measures (e.g., limiting platform access) and active approaches (e.g., highlighting hidden dangers; Padilla-Walker et al., 2012). However, such mediation is more common in younger children, which could explain the lack of a connection in our study focusing on adolescents.

10.3. Role of Risky Factors

Sensation seeking emerged as a potential risk factor for intentional EHOC in all frequency categories, consistent with prior research (Helsper & Smahel, 2019). Sensation seekers are drawn to HOC for the thrills it offers (Pikó & Pinczés, 2019). Low life satisfaction, corroborating earlier findings on online risky behavior (Stoilova et al., 2021), is linked to higher intentional EHOC. This suggests that adolescents may engage in risky online behaviors as a maladaptive coping mechanism for dealing with low life satisfaction (Valois et al., 2002), such as seeking content related to unhealthy dieting when dissatisfied with their bodies. Furthermore, the curvilinear findings reveal that adolescents scoring the lowest in life satisfaction do not experience the same continued increase in intentional EHOC. This could suggest that adolescents with extremely low life satisfaction may shift toward different coping mechanisms, possibly moving away from HOC as they explore other forms of distraction or escapism (Jiang et al., 2019; Milas et al., 2021). Additionally, it is possible that these adolescents develop a heightened awareness of the negative impacts of HOC on their emotional state, prompting a self-regulatory reduction in intentional exposure. In some cases, severe dissatisfaction may

result in a general lack of motivation, avoidance, or shifting to offline risky activities, such as alcohol or drug abuse (Milas et al., 2021), reducing their drive to seek out HOC.

Sensation seekers are consistently associated with higher unintentional EHOC across all frequency categories, aligning with prior research (Helsper & Smahel, 2019). This may suggest that their penchant for exploring various online spaces (Sheldon, 2012) increases the likelihood of inadvertently encountering such content. Nevertheless, the observed curvilinear relationship suggests that as sensation-seeking behavior in adolescents increases, the likelihood of unintended EHOC initially rises; however, among those with a very high level of sensation seeking, this likelihood plateaus. One explanation for this pattern could be that adolescents with the highest levels of sensation seeking may have developed specific strategies or knowledge about where to find the thrilling content they seek intentionally, reducing the chance of "accidental" EHOC. This aligns with research that suggests that sensation seekers may exercise more selective exposure, filtering their digital environments to engage primarily with the specific content they desire, usually containing high sensory stimulation (Lin & Tsai, 2000). Another explanation could involve desensitization or a change in perception regarding what constitutes harmful content. High-sensation seekers, who are often drawn to intense or thrilling experiences, might not perceive certain types of content as "harmful" or "unintended" once they have been repeatedly exposed to it. This could mean that their threshold for what they regard as harmful is higher, resulting in reporting less unintentional EHOC than those with lower sensation-seeking levels.

The observed association between lower life satisfaction and higher unintentional EHOC was affirmed in all frequency categories, suggesting that individuals seeking distractions due to life dissatisfaction might spend more time online and thus stumble upon various content, including HOC. The observed association between lower life satisfaction and higher unintentional EHOC across all frequency categories supports the notion that adolescents who experience dissatisfaction may spend more time online seeking distractions. This increased online time might inadvertently expose them to a wider variety of content, including HOC. This interpretation is consistent with the idea that, for individuals experiencing lower life satisfaction, online activities may serve as a coping mechanism or escape, albeit one that increases the risk of unintentional EHOC. Additionally, this pattern raises the possibility of a reversed relationship, where unintentional EHOC negatively impacts life satisfaction. Encountering HOC on social media could be negatively associated with adolescents' well-being by reinforcing feelings of distress, depression, or anxiety (Blanchard et al., 2023; Keles et al., 2019). This bidirectional relationship suggests that adolescents who are already vulnerable due to lower life satisfaction may become caught in a feedback loop: Lower life satisfaction leads to more time online (i.e., seeking distraction), which in turn raises the likelihood of EHOC, further diminishing life satisfaction.

10.4. Limitations and Future Directions

Our study has limitations worth noting. The knowledge-skills scale (Helsper et al., 2020) exhibited insufficient reliability due to its broad scope and low inter-item correlations, suggesting a need to divide it into smaller, related items for future research. The missing values observed in the dependent variables could be due to the sensitive nature of EHOC, leading some young individuals to prefer not to respond. The cross-sectional design constrains causal interpretations, warranting longitudinal and complex models for a comprehensive understanding of the factors that precede and follow intentional and unintentional EHOC. Future research can explore the differences among the sub-forms of HOC as well as focus on the country

differences. Additionally, follow-up studies may explore the motivations behind intentional and unintentional EHOC, or whether parental mediation and parental digital skills play a role. Even though we have observed a correlation between higher digital skills and unintentional EHOC, research (Donoso et al., 2020) indicates that digital skills can mitigate harm. Therefore, future studies may examine how skilled adolescents manage such exposures, assessing whether higher skills aid in coping, preventing harm, and fostering resilience to the effects of EHOC.

11. Conclusion

This study explored the cross-sectional associations between digital skills and EHOC among adolescents. By focusing on various subtypes of digital skills, we found that specific skills were associated with unintended EHOC, indicating potential risk factors. Building upon Jessor's problem behavior theory (1987), our research extended the investigation of risky and protective factors to the online environment. Sensation seeking and low life satisfaction were found to be associated with intentional and unintentional EHOC, while family support was suggested to be rather protective, particularly in cases of frequent EHOC. Friend support, typically considered a protective factor, was found to be associated with harmful content exposure, possibly acting inversely as a risk factor, as suggested by previous studies (Kvardova et al., 2021). These findings emphasize that merely possessing digital skills was not found to guarantee their effective use in safeguarding adolescents from EHOC. This underscores the importance of comprehensive prevention strategies that simultaneously incorporate digital skills and address risky online behaviors. Educators and parents should grasp the dual nature of digital skills to guide children in maximizing the opportunities of ICTs while mitigating the associated risks.

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Conflict of Interests

The authors declare no conflict of interests.

Data Availability

The research data associated with this article can be found in Machackova et al. (2024).

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Beyond Digital Literacy: Exploring Factors Affecting Digital Performance of University Staff

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Abstract

Digital literacy is essential but doesn't guarantee digital performance. Many researchers consider factors such as attitude, cultural environment, or institutional setting in their frameworks when researching digital literacy. Yet, their significance often gets lost in a catalog of required skills and knowledge. Here we develop a model outlining factors influencing university personnel's digital performance across diverse tasks, and we discuss associated challenges. The model derives from literature and insights from 20 qualitative interviews with academic staff in teaching, research, or consulting roles. Results show that institutional settings and employee empowerment are pivotal in shaping openness to digital tools. Intentions fail due to resource constraints and lack of recognition, leading to limited experience with digital opportunities. Well-being significantly influences willingness to embrace digital resources amidst the balancing act of anticipating future efficiency against investing time and resources. Maintaining a team atmosphere often results in alignment with the least digitally competent. With appropriate conditions, time resources, and support, staff could efficiently utilize digital resources, even with only basic skills, which fosters the integration of all workforces. We argue for comprehensive assessments of university employees' digital performances, considering context and holistic aspects beyond personal skills and knowledge. Our model encompasses digital literacy, openness to digital developments, digital culture, primary conditions, services/empowerment offerings, and mindfulness.

Keywords

academic digital literacy; digital culture; digital literacy; digital performance; digital well-being; empowerment

1. Introduction

The wave of digitization has swept through every facet of university life, making digital tools indispensable. The Covid-19 pandemic has further accelerated this shift, as the abrupt move to online teaching and the increased use of digital technologies in academic activities have highlighted the critical importance of digital literacy for both staff and students. University staff are constantly faced with selecting and using these emerging digital resources wisely. Efficiency, resource conservation, and forward-thinking approaches are essential to navigating this dynamic landscape, especially in environments dedicated to research and educating students. New technologies are the catalyst and starting point for changing the structures and processes of working, learning, decision-making, and communicating. The scope is broad: University staff need to navigate digital tools in teaching and research, knowledge transfer, administrative tasks, and self-presentation. Digital literacy and adaptability to the ever-evolving digital landscape get more attention.

Many studies place their spotlight on media literacy or digital literacy. We assert that this focus overlooks what is genuinely central: the digital performance itself. Trültzsch-Wijnen (2020) points out that skills alone don't guarantee performance. Attitudes are central for digital literacy and for using digital tools (Arthur, 2013; Ferrari, 2013; Martin & Grudziecki, 2006; Meyers et al., 2013; UNESCO, 2013). Vuorikari et al. (2022, p. 3) describe attitude "as the motivators of performance, the basis for continued competent performance. They include values, aspirations and priorities." Moreover, a study in the realm of volunteer work (Koch & Klopfenstein, 2021) highlights that organizations can enhance the digital performance of volunteers by establishing conducive environments and setting digital framework conditions despite the volunteer's partly low digital literacy.

Our premise is that several factors—digital literacy is one—impact the digital performance of academic staff. As individuals who use digital tools daily, they are an interesting group. They are regularly exposed to innovation and are accustomed to adapting to new developments as part of their professional routines.

The following research questions guide our study:

RQ1: What challenges do academic staff meet in their digital performance?

RQ2: What factors influence the digital performance of academic university staff?

The aim is to identify the factors influencing digital performance and their characteristics. For this purpose, a model of the factors of influence will be proposed at the end of the article.

2. Theory

In this study, we argue that digital literacy, along with other factors, contributes to more effective digital performance. Aavakare and Nikou (2020, p. 11) for example found "a direct and significant relationship between information literacy and university staff's intention to use digital technologies for work activities." As Trültzsch-Wijnen (2020) argues, a reciprocal relationship is to be expected, where digital performance can also influence and improve digital literacy. Moreover, various individual factors, such as environmental factors, would moderate the transfer (e.g., motivation, interest, and memory). The practical sense of media

use is relevant for media performance, but also for the acquisition of media literacy. These statements on media performance are transferable to digital performance. In the following sections, we explore distinct aspects of the digital performance of academic staff, beginning with digital literacy (Section 2.1) and moving into the higher education context, which includes academic literacy and practice (Section 2.2). The discussion of technology acceptance (Section 2.3) is crucial to understanding how digital technologies are adopted, with organizational factors and digital culture playing significant roles. Digital culture and digital well-being (Section 2.4) are finally discussed as essential for sustaining digital engagement and ensuring academic staff maintain a healthy balance in increasingly digital environments.

2.1. Digital Literacy

Digital literacy is a highly contested term due to its broad and varied interpretations. The ambiguity surrounding its definition has its origins in the multiple disciplinary perspectives, contexts, and areas of application (e.g., entertainment, communication, working tools) in which the term is applied, to name but a few. Moreover, some definitions emphasize technical competencies, while others prioritize critical thinking, often referred to as critical literacies (Aguilera & Pandya, 2021). The wide range of different but similar concepts (Bawden, 2008; Koltay, 2011), such as media literacy, information literacy, internet literacy, and 21st-century skills (van Laar et al., 2018) blurs the discussion even more. A topic that is often discussed is whether these concepts complement each other, overlap, or are hierarchically related. UNESCO (2013, p. 27) argues that "is important to shift the focus away from the fragmentation of and differences among literacies towards what they have in common."

The problem of definition goes further, as Knobel and Lankshear (2006, p. 15) explain:

> Most definitions construct digital literacy as an It—as some kind of a "thing:" a capacity or ability, a skill (or set of skills) or "master competency" (composed of more specific competencies and dispositions). It is something you "have" or lack, and anyone who lacks it "needs" to get it.

Many definitions conform at their core to the notion that digital literacy consists of knowledge, skills, and attitudes (Martin & Grudziecki, 2006). While knowledge is acquired through learning and consists of facts, principles, theories, and practices on a particular topic, skills are needed to apply knowledge, complete tasks, and solve problems. Attitudes as the basis for performance include values, aspirations, and priorities (Ferrari, 2013). They are needed:

> To use ICT and digital media to perform tasks, solve problems, communicate, manage information, collaborate, create and share content, and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socializing, consuming and empowerment. (Ferrari, 2013, p. 3)

The pyramid model by Celot (2015)—developed to measure media literacy in Europe—acknowledges the interaction of individual skills, social (communication) skills, and personal skills (critical understanding, usage skills), with environmental factors. These factors include the availability of media and the media literacy context (media education, media literacy policy, civil society, and media industry). They can promote or inhibit individual skills and should not be neglected. A widely discussed model in the educational context is

that of Sharpe and Beetham (2010), who describe digital literacy as a hierarchical structure, with access at its foundation. Access includes not only the availability of technology but also the time for its use. Bennett (2014) adds access to supportive individuals. The next levels involve skills (such as information literacy, cognitive abilities, and interaction skills), practices (e.g., making informed decisions and developing personal strategies), and at the top, attributes. While access is a prerequisite, it is arguable whether skills, practices, and attributes are truly hierarchical, or if they are more intricately intertwined. One way or another, the proposed levels offer valuable guidance for exploring digital performance in the academic field. As Sharpe and Beetham's (2010) model is quite general, it is also relatively stable over time.

Overall, definitions struggle to keep up with the rapid change in social and technical reality (Meyers et al., 2013). Therefore, Chetty et al. (2018) argue that a definition must describe the subcomponents, which must be continually developed. Many researchers and educators use comprehensive frameworks for this purpose (amongst others Carretero et al., 2017; Clifford et al., 2020; Eichhorn, 2020; Jisc Data Analytics, 2024; Vuorikari et al., 2016). The challenge is to keep these frameworks up-to-date while avoiding too much generalization.

Often mentioned is the EU Digital Competences Framework (DigComp; Vuorikari et al., 2022), which identifies five areas of digital literacy comprising a total of 21 competencies: Information and Data Literacy involves the ability to locate, evaluate, and use digital information effectively, whereas Communication and Collaboration focus on interacting, sharing, and collaborating through digital technologies. Digital Content Creation covers the ability to create, edit, and manage digital content. Safety refers to protecting devices, personal data, privacy, and health in digital environments, and Problem-Solving includes identifying digital needs and problems, evaluating technological solutions, and adapting to evolving digital tools. Jisc Data Analytics (2024) presents another framework, which aligns with many of DigComp's main categories. It expands on them by including "digital learning and development" (covering digital teaching). Another notable aspect is that it elevates "digital identity and wellbeing" (more details below) by assigning it a dedicated category. In contrast, in the DigComp model, this is subsumed under "safety" along with topics like data protection.

Many digital literacy frameworks (Ferrari, 2013; Jisc Data Analytics, 2024; van Laar et al., 2017) address thinking skills such as critical thinking, creativity, and innovation. Still, it is argued that frameworks like DigComp could better integrate higher-order thinking skills, such as the development of responsibility (Garavaglia et al., 2022), as well as analytical and interdisciplinary thinking, which are especially crucial in Industry 4.0 environments (Ozkan-Ozen & Kazancoglu, 2022). To highlight differences between technical and critical digital literacy, discussions around critical digital literacy have gained prominence. Critical digital literacy emphasizes reflection, awareness, and a critical attitude (Ilomäki et al., 2023), encouraging individuals to become more conscious of how power dynamics shape thought and behavior in digital spaces (Darwin, 2017).

While frameworks offer a useful foundation for establishing a mutual understanding, adapting these frameworks to specific contexts requires additional effort (Vuorikari & Punie, 2019). In line with this limitation, Jahn et al. (2021) highlight the issue that requirements and application scenarios vary widely, criticizing the DigComp framework for being too general. Consequently, in this work, we aim to explore competencies tailored to the specific tasks and responsibilities of academic staff.

2.2. Academic Digital Literacy

A specific context is the workplace. Here, digital skills are needed to enable business, government, and education employees to apply digital technologies, use them as part of their job profiles, and drive the digital transformation of business processes and institutional workflows (Friedrichsen & Wersig, 2020). Efficiency is essential: "Digital competencies at work are a set of basic knowledge, skills, abilities, and other characteristics that enable people at work to efficiently and successfully accomplish their job tasks regarding digital media at work" (Oberländer et al., 2020, p. 5).

This applies to academic staff too, but a closer examination is required due to the complexity of the field and the diverse responsibilities of academic employees. Wedekind (2009) and Reinmann et al. (2013) use academic media literacy to describe the competencies needed in this specific context. Eichhorn (2020) equates it with academic digital literacy, given that most media are now digital. Frameworks like the Digital Capabilities Frameworks by Jisc Data Analytics (2024) also address universities but focus mainly on the pedagogic, teaching aspect. However, teaching is only one of their many responsibilities. Basantes-Andrade et al. (2022) emphasize the need to consider digital literacy concerning the dimensions of teaching, research, management, and community engagement. Eichhorn (2020) differentiates three main areas of work at universities, namely teaching (media didactic skills), academic work (conducting research tasks), and academic self-administration/organization (controlling the flow of information in teaching and events, presenting own research and institute profile). From earlier models, Eichhorn (2020) derives eight dimensions of digital skills, which are independent of any scientific discipline:

- IT skills;
- Information skills;
- Communication/collaboration skills;
- Digital teaching;
- Digital identity, career planning;
- Digital science;
- Digital production;
- Analysis/reflection skills.

He bases digital literacy on three levels: (a) overview of knowledge and basic skills, (b) practical application, and (c) guiding others in the acquisition of digital skills.

In the area of teaching digital skills, Basantes-Andrade et al. (2022) highlight the importance of integrating ICT effectively into the pedagogical context while considering safety criteria. Krumsvik and Jones (2013) further emphasize the need for an understanding of how digital strategies impact student learning.

Many studies on the digital competencies of academic staff focus on teaching, especially after the Covid-19 pandemic increased attention to online education. Beardsley et al. (2021) observe that, since the outbreak of the pandemic, technologies are being used with greater confidence and motivation in teaching. External coercion has enabled a positive experience. Studies (Beardsley et al., 2021; Cutri et al., 2020; Fernández-Batanero et al., 2021; Inamorato dos Santos et al., 2023) show that academic staff have an open attitude towards using digital technologies in the classroom. In practice, however, they rarely use them, with

limited time and resources being cited as the main barriers (Fernández-Batanero et al., 2021). Studies from South American countries, as well as Spain and Portugal (Fernández-Batanero et al., 2021; Inamorato dos Santos et al., 2023), highlight both a gap between the willingness to use digital resources and their actual application, as well as a low to moderate level of digital competence among university teachers. Teacher training programs have shown limited success, which is why Fernández-Morante et al. (2023) advocate personalized training plans and Inamorato dos Santos et al. (2023) self-reflection as a first step.

The perception of the use of digital tools in teaching at universities is positively influenced when institutions provide support (Fernández-Morante et al., 2023) and when infrastructure is well-developed (Inamorato dos Santos et al., 2023). However, the lack of clear guidelines complicates the situation for university teachers (Louw & Thukane, 2020). Romero-Hall and Jaramillo Cherrez (2023, p. 159) criticize the fact that higher education institutions often lack "unified practice or administrative plans for integrating digital technologies at the institutional level," which results in staff struggling with digital skills. Optimism is a key factor in the successful use of digital technologies (Cutri et al., 2020). When benefits are seen, digital tools are more likely to be adopted. As Bennett (2014) notes, educators must focus on achieving their pedagogical goals rather than becoming digital experts.

2.3. Technology Acceptance

The question arises as to what influences the use of digital tools? The discussion around technology acceptance tries to provide answers that are also of interest here. Davis et al. (1989) assume in their technology acceptance model (TAM) that perceived usefulness and perceived ease of use are crucial factors. Based on this, Venkatesh (2000) adds the factors of subjective norm (the influence of colleagues or supervisors, as well as image, i.e., how using the technology enhances an individual's reputation) and cognitive factors like job relevance, perceived quality of outcomes, and visibility of outcomes.

Moreover, Venkatesh and Davis (2000) consider the user's prior experience with the technology and whether its use is voluntary or mandatory. TAM3 (Venkatesh & Bala, 2008) adds computer self-efficacy and perceived external control, which describes the extent to which users believe they have access to the necessary resources and support to use the technology successfully. This is an aspect particularly important in workplace settings, including universities. TAM3 also recognizes the importance of emotional factors like enjoyment and anxiety when using technology. A study by Nikou et al. (2022) shows that these emotions and attitudes are directly influenced by information and digital literacy. By accounting for these diverse cognitive, emotional, and contextual factors, the TAM3 offers a more nuanced understanding of the complex processes that drive technology acceptance. This multi-dimensional approach is particularly valuable in environments like academia, where personal beliefs, organizational culture, and external pressures all converge to influence how and why individuals embrace new technologies. The different TAM models, however, do not recognize technology acceptance as a dynamic, ongoing process. Another limitation is that it is too general and requires significant effort to adapt to a specific context while also being complex in terms of combining many different variables.

Although organizational factors are addressed in TAM3, they are underrated. In their version of TAM, Busolo et al. (2021) build their own categories. They differentiate between human, technological, and organizational variables, with the latter including policies, strategies, management, leadership, training, and security.

By incorporating these organizational factors, they emphasize the crucial role of institutional culture, leadership, and strategic alignment in fostering an environment conducive to technology adoption. This highlights the fact that successful implementation depends not only on individual and technological readiness but also on cohesive organizational frameworks. In universities, institutions often navigate complex technological ecosystems that require strong organizational coordination. Moreover, aligning leadership and strategy with technological initiatives ensures that faculty receive the necessary support and resources.

2.4. The Role of Digital Culture and Well-Being

The digital transformation era requires organizations to use digital technologies productively and to manage the associated changes internally, aligning them with stakeholder interests and their values and goals (Rosenberger et al., 2023). Digital change is a permanent feature of employees' working lives and requires openness and adaptability. According to Murawski and Bick (2017), beyond employees' mindsets and skills, the company's culture plays a pivotal role. Similarly, Meyers et al. (2013) define digital literacy as encompassing three key aspects: (a) the acquisition of "information age" skills, (b) the development of critical thinking habits, and (c) active engagement in digital cultures and practices. As already discussed above, skills and knowledge are highly contextual and develop differently in different contexts. According to Chief Digital Officer Ian Rogers (Buvat et al., 2017), digital transformation is not just a technical matter but a cultural change. Collard et al. (2017, p. 147) hypothesize "that the performance of competences through work practices may be affected by how DML [digital media literacy] at work is discursively constructed in organizations."

Building on the discussion of digital culture, employee well-being plays a crucial role in the digital workplace. Access to new technologies is motivating, and institutional support can contribute to positive emotions among employees, enhancing their engagement with and promotion of digital tools (Mäkiniemi, 2022; Moreira-Fontán et al., 2019). While the digitalization of work offers numerous opportunities, it also presents challenges to mental well-being. For instance, research shows that ICT can negatively affect well-being by increasing interruptions and unpredictability (Hoeven et al., 2016). The concept of "technostress" highlights the pressure employees feel when working with digital technologies, often linked to the rapid pace of change and increased expectations (Mäkiniemi, 2022). New forms of human–machine interaction can add to this strain (Körner et al., 2019), with stressors such as technical difficulties, poor usability, low situational awareness, and the need to acquire new skills (Pfaffinger et al., 2023). Technical issues are particularly stressful when employees lack the competence to resolve them (Dragano et al., 2021). A finding by Bartra-Rivero et al. (2024) concludes that improving digital literacy can reduce technostress among teachers.

Well-being, therefore, must be considered to be an important aspect of digital performance and digital literacy. Many frameworks subsume well-being under safety and security categories. Audrin et al. (2024) attribute even more importance to it by assigning well-being its own category in their model for digital competence in the workplace. The concept of digital well-being addresses "the impact of technologies and digital services on people's mental, physical, and emotional health" (Shah, 2019, para 2) and can be understood as "the ability to protect oneself and others from threats to the integrity and health consequent from digital technology use" (Audrin et al., 2024, p. 3). From an individual perspective, this entails recognizing both the positive and negative effects of digital activities and learning to manage them to

enhance well-being. Shah (2019) also highlights the responsibility of organizations to ensure proper management of digital systems and adequate training for employees in the use of digital tools. She further points to the availability of digital tools that can assist in managing aspects of digital well-being, such as digital stress and workload. Pfaffinger et al. (2023), for example, demonstrate the effectiveness of a low-dose app-based meditation and cognitive behavioral intervention in improving general well-being, which can be beneficial for individual stress management within organizations.

3. Methodology

The study employed qualitative, semi-structured interviews of about 45 minutes to an hour with 20 academic employees in autumn 2022, conducted via videoconferencing. The interview guide included a list of open-ended questions with some flexibility in the order and follow-up questions (Loosen, 2015). The aim was to create a conversation situation that was as natural as possible while keeping a structured approach to allow for a certain degree of comparability (Loosen, 2015). The primary objective was to gain new insights rather than to test existing knowledge. This approach offered in-depth insights into the academic staff's reception and experiences. The project has been reviewed by a committee within the university for both feasibility and ethical approval.

It was designed as a comprehensive case study of a single Swiss-German university, which unites various disciplines across the entire spectrum, from natural sciences to sociology and technology, under one roof. It allowed the research to be conducted under comparable overarching conditions and provided diversity through the different departments and disciplines.

The respondents are researchers and lecturers. Except for two, all have dual roles. For some, the teaching aspect is more prominent, while for others, research takes precedence. Two to three employees from each department from different scientific disciplines were interviewed. Table 1 gives an overview of the sample.

We use the term "digital tools" to describe software applications and platforms that enable people to communicate, learn, collaborate, collect, analyze, visualize, share data, and create, store, search, and find digital content (based on Vuorikari et al., 2016). Digital communication and collaboration tools are platforms or applications that allow users to communicate digitally, exchange information, collaborate, share documents, and organize workflows. They include a variety of functions (e.g., instant messaging,

Table 1. Sample overview.

		Number of respondents
Age	Up to 35 years	4
	36 to 50 years	10
	Over 50 years	6
Gender	Male	10
	Female	10
Positions	Lecturer/professor	9
	Mid-level faculty member	11

conferencing, collaborative document editing, task management). Digital tools for teaching include all digital tools used in the classroom (e.g., Moodle, Miro, Padlet, and quizzes).

Based on university job descriptions and theoretical insights (Section 2.2), a preliminary task portfolio was created to identify where digital tools could be applied. Key areas include project management (data handling, collaboration, administration), empirical research (data collection and analysis), and teaching (course preparation, delivery, and follow-up). Staying updated on practical and scientific trends, effective communication with stakeholders, networking within academic and professional circles, and building a digital identity were also emphasized. Additionally, self-management (information, resources, well-being) and administrative tasks (time tracking, software management) were included. While not exhaustive, this portfolio provided a valuable framework for structuring the interviews and guiding discussion.

The interviewer started by introducing the study, explaining that the data would be collected anonymously, and clarifying the participants' roles, areas of responsibility, and tasks at their work. This initial step provided the basis for tailoring the subsequent questions and for probing deeper into specific areas. Thematically, the interview first focused on a self-assessment of their digital practice and literacy on the one hand and a team evaluation on the other. As shown in the theory section (Arthur, 2013; Ferrari, 2013; Meyers et al., 2013; Nikou et al., 2022; UNESCO, 2013), attitude plays an important role in digital performance. Therefore, participants were asked about their openness and attitudes toward digital tools in their work, their perceived flexibility in experimenting with new technologies, and any fears or barriers they encountered in using digital tools. They also provided insights into their team's attitudes, reflecting on the collective disposition towards digital innovation. Not only does the mindset of employees (Murawski & Bick, 2017) influence digital performance, but also the companies' digital culture (Busolo et al., 2021; Collard et al., 2017; Venkatesh & Bala, 2008). That's why respondents were asked to assess the degree of digital transformation of the university and their perception of the university's digital culture overall. The answers also help to contextualize other answers in terms of access, conditions, and possibilities. The subsequent part of the interview centered on the participants' specific work areas, as the digital challenges and competencies needed may be context-specific (Jahn et al., 2021). We explored how they used digital tools in project management, collaboration, teaching, research, and monitoring—both individually and as part of a team and also addressed experiences and challenges. Moreover, we asked about digital tools in their communication practice, including publication work, knowledge transfer, dialogue, and networking, and the use of administrative tools for digital administration. A dedicated section of the interview focused on digital well-being, as digital tools are potential stressors (Dragano et al., 2021), but also stress reducers (Pfaffinger et al., 2023). This included questions about the tools respondents used to manage their well-being (e.g., focus-enhancing tools, quiet work environments) as well as the impact of digital work on their overall well-being, such as concerns about burnout, information overload, and constant availability. Issues related to digital literacy emerged organically throughout the interviews, and a final section explicitly addressed this topic. Participants were asked to identify the digital competencies they considered most critical for university staff.

The guideline interviews were fully transcribed and analyzed using Mayring's (2022) summarizing content analysis. Categories were derived inductively from the interview material. Starting with reducing and consolidating the existing material, the identification of recurring themes and patterns was then summarized into categories. This was done first block by block within each interview and then at the entire interview

level. We worked with main categories, subcategories with more details, and corresponding anchor quotes. Two people analyzed the interviews in parallel through a repeated, recursive process that ensured consistent categorization. Citations were recorded for each category. Although the frequency of mention was counted, the focus was on identifying and capturing the range of influencing factors and challenges. For practical application, the findings were translated into an assessment tool that university institutes and teams can use to determine their current status.

4. Results

The study identified six areas of influence on the digital performance of academic staff, which are discussed together with the corresponding challenges. These areas are digital practice, attitude, digital knowledge and skills, digital culture, framework conditions, and service and empowerment. The transitions between the areas are fluid and show how strongly they influence each other.

Although all respondents use digital tools daily, 14 out of 20 interviewees limit them to the most basic, pragmatic use possible to avoid potential complications. Digital tools often replace other applications one to one, and their potential is not exploited. The openness to go beyond the simple sharing of a shared repository and to work digitally collaboratively is limited ($n = 14$). Nevertheless, the variety of digital tools is significant, as everyone uses something different. This poses a challenge when collaborating with various teams from different departments or universities ($n = 6$). Online monitoring of current developments in science and practice happens casually and rarely. Except for three respondents, science communication via online channels is hardly ever practiced—the respondents are even deliberately reticent ($n = 7$). Respondents are open to using administrative tools and see them as a prerequisite. However, only three people go beyond and use administrative tools for time management.

There is little reflection on personal well-being when using digital tools but the respondents find it essential to address this issue and are interested in digital tools to promote mindfulness ($n = 14$).

4.1. Attitude, Knowledge, and Skills

Respondents found openness and curiosity ($n = 8$), pragmatism and patience ($n = 6$), and flexibility to be critical characteristics for digital performance. Twelve describe themselves as open-minded towards digital tools; however, they report a lack of patience for them and therefore use digital tools at a low level. Seven respondents are open to digital tools and think they make teaching more attractive and try novel approaches. They see innovations as an opportunity. Their flexibility and attitude that experience can be transferred from one tool to another pays off, leading to them overcoming hesitation and fears. Nine are not averse, but more cautious. They don't have confidence that digital tools will always bring benefits: "You get bogged down so quickly. It's very wild with all the tools. The ones you don't know well enough, you become inefficient" (Interviewee [henceforth Int.] 19). Four explicitly lack patience and interest in learning: "You don't know the tool, so you don't want to learn it" (Int. 2). They report frustration when something doesn't work as expected and see dealing with it as a waste of time. Fears hinder them from working with new digital tools. Common fears include data loss and synchronization issues ($n = 5$), losing track of multiple data repositories ($n = 3$), or losing control ($n = 4$). One explains: "That feeling of 'are the others not seeing the document. Is it secure?' is a barrier. So I just make another Word document and share it by email." (Int. 1). The fear of technical

difficulties is inhibiting teaching. Employees are also reluctant to present themselves on social media platforms ($n = 2$), and it is a hurdle to share content publicly as they're afraid of a backlash (Int. 8). Moreover, they criticize the way that social media blurs the lines between personal and professional life.

Basic user skills and knowledge are considered essential, as this can be transferred from one digital tool to another. One respondent stressed: "If you can do one, you can usually do the others" (Int. 6). Some find it difficult to have an overview of the range of digital tools, their possibilities ($n = 6$), and limitations ($n = 3$). A good selection of digital tools includes the consideration of one's competencies (Int. 9) and the team culture ($n = 3$). Implementing new digital tools often fails due to a lack of awareness of possibilities and missing resources. This applies to project management, teaching, administration, and mindfulness. The efficient and meaningful use of digital tools is considered crucial ($n = 9$), and the importance of using digital advantages and not simply transferring analog processes to digital tools is highlighted (Int. 3). Other skills considered are process management skills, including the organization and overview of workflows ($n = 4$), a holistic use approach (Int. 9), the ability to handle large amounts of data ($n = 5$), and to avoid data loss (Int. 12). Although considered essential, basic knowledge of data protection ($n = 3$) and awareness of its relevance ($n = 4$) bore and overstrain many ($n = 8$). Int. 15 illustrates the challenge: "If the tool tells me in which country the data is stored, then I still don't know what to do with it." Finally, problem-solving skills, i.e., the ability to tackle problems independently, were emphasized ($n = 3$).

4.2. Digital Culture, Framework Conditions, and Services

When it comes to digital culture, the attitudes, practices, and competencies within the team play a crucial role. While six teams are perceived as very open-minded and digitally adept, amongst all others, there is great diversity in terms of openness and competence. Seven pointed out a generational difference, with older people often showing signs of being more easily overwhelmed and less open to new digital developments. Digital collaboration initiatives fail due to implementation problems: "Everyone likes to try things out, but we're not so strong when it comes to implementation" (Int. 3). After the initial euphoria, digital tools are reduced because colleagues lack the willingness and patience to get involved ($n = 8$). Most teams miss role models ($n = 15$). Digital culture is tailored to the needs of those least open to and competent in using digital tools to accommodate the various levels of knowledge (Int. 13). Digital project management tools are not used extensively to avoid potential overload and conflicts, as one quotation illustrates: "You don't ask to share it in MS Teams, although it would be easier. Because every conflict comes down to trivial things like that" (Int. 2). A fear-free environment where mistakes are allowed promotes the willingness to try things out ($n = 3$), especially if valued by supervisors and the team ($n = 3$). It is manifested in the framework conditions of the university. This also applies to the (perceived) degree of digital transformation of the university (e.g., software offered, innovative administrative tools, digital platforms), which respondents adapt. If a university is not innovative, adaptation often means downgrading ($n = 5$).

Respondents emphasize the importance of having user-friendly, intuitive, and modern digital tools ($n = 12$). Especially in teaching, technological hurdles can be too high (usability of platforms, lack of interfaces between different digital tools), as there is little room for maneuver during a course ($n = 8$). Int. 3 would prefer digital solutions to be developed at the institute level, as this allows for better consideration of employees' specific working contexts and challenges, ensuring the solutions are more tailored to their needs. Lacking time resources hinders 17 respondents from becoming familiar with new digital tools: "You need

know-how, but you also need a lot of time. Where does this time come from?" (Int. 4). The idealism need is missing when there is low interest and appreciation from supervisors (n = 14). Lack of resources can lead to falling back into old habits (n = 7). University members frequently work in inter-university teams, which all have different requirements for digital tools and platforms, other access, or different hardware (not all programs run on all devices), making collaboration difficult (n = 8). Data protection rules and ethical concerns can make it challenging to choose digital tools (n = 3) and hinder practicability: "I agree that you have to be extremely careful and take a close look at it, but I'm very slowed down by it" (Int. 2).

Employee training is not encouraged enough: "I have never received a request to look at manuals or training courses" (Int. 1). Relevance could be emphasized, e.g., by setting an annual goal in the appraisal interview. The dilemma is that although training is desired, it is not used due to lack of time (n = 2). The experience shows that training is not sufficiently tailored to the individual case (n = 8). Contact persons in the immediate environment who are familiar with the situation are desired (n = 6): "I think that many people are not aware of how different the approach to digital tools is" (Int. 16). Ultimately, the university needs to provide a service that saves the academic staff time, for example, by showing them what tools are currently available, curating them in terms of data security and ethics, and providing a personal, in-house contact person who knows the environment and helps with specific problems.

5. Conclusion

5.1. Challenges

The results section brought up many challenges that teams face. Time resources to think things through, keep an overview, or keep track of the diversity of options are some of the biggest problems. As a result, teams adapt to the one with the lowest digital level, and initial efforts to try something are often abandoned. Overall, some areas of tension can be named as the following. Freedom of choice vs. uniformity as many want to choose if, what, and how to use digital resources. Restrictions and guidelines from the university are perceived as limiting and devaluing. However, more uniformity is desired so that different communication channels, platforms, and management tools don't have to be managed in parallel. Unification eases the development of a consistent, long-term understanding of collaboration and communication and support services could be more focused.

Simplicity vs. variety concerns respondents' desire to focus on a small number of digital tools that offer many distinct functions. At the same time, the versatility of digital tools is seen as a challenge, as it is difficult to keep track of all possibilities.

Freedom of choice vs. data protection where the desire for freedom of choice collides with data protection. Even if the relevance is undisputed, the requirements are challenging, especially when working with external partners.

Openness vs. priorities concerns when the interest in engaging with new digital tools clashes with one's priorities to focus on research, advising, and teaching and not spend time understanding digital tools. This aligns with Fernández-Batanero et al. (2021) and Inamorato dos Santos et al. (2023), who identified a gap between openness to digital practices and actual digital action.

Finally, the demand for training vs. resources concerns respondents' wish for training and information-sharing platforms. However, they rarely take advantage of such opportunities due to a lack of time and resources.

5.2. Influencing Factors

Based on our research and the literature review, a model of the factors influencing digital performance was developed. The model (see Figure 1) includes the following dimensions: digital performance, motivation, digital culture, conditions, and services and empowerment.

Digital performance (Trültzsch-Wijnen, 2020) refers to whether and how digital tools are used in research, educational tasks, monitoring, scientific communication, administration, and self-management. We found different moderating factors that influence performance.

Motivation stems from openness and patience to try new things, as well as from the attitude that digital tools can be used to one's advantage. The more employees worry about technical issues or fear that they might fail, the less likely they are to try new things. It demonstrates the importance of "cultivation of 'habits of mind,' " as Meyers et al. (2013, p. 13) explain, and confirms the importance of mindset (Murawski & Bick, 2017) and attitudes often noted in literacy definitions (Martin & Grudziecki, 2006). TAM (Davis & Granić, 2024) can address many motivational aspects. For example, it is driven by perceived usefulness and usability, job relevance, and personal experience, self-efficacy but also by existing fears. To do justice to the importance of this dimension, it is not treated here as part of digital literacy but is included separately. It can be influenced and encouraged, while digital skills and knowledge can be learned.

Respondents agree that a certain level of digital literacy—knowledge and skills—increases motivation and flexibility to adapt and test new things, but it is not their primary concern. Eichhorn's (2020) list of digital skills aligns with their assessment of what is essential. However, they state that basic user knowledge and

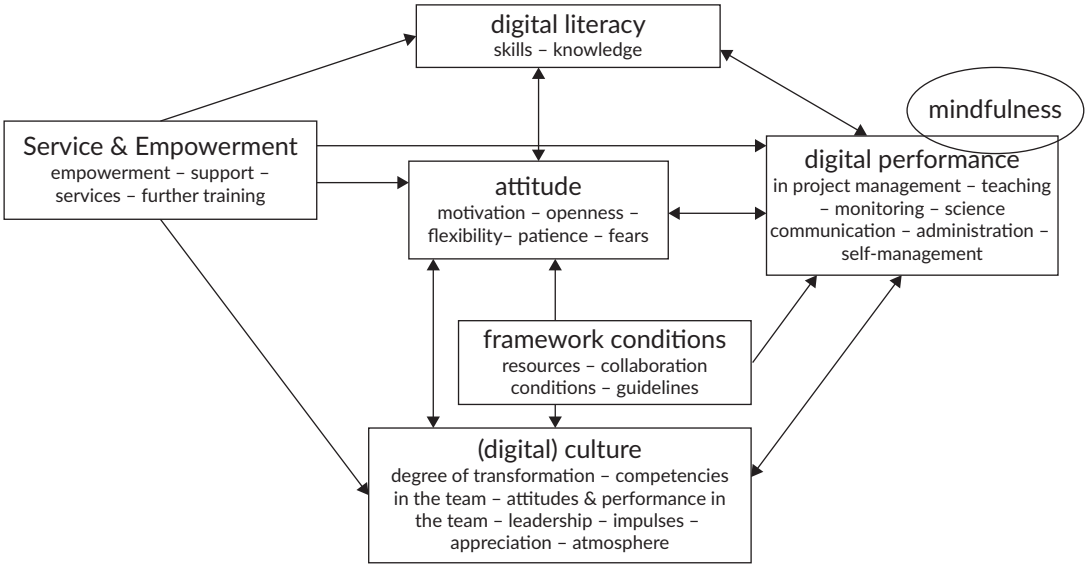

Figure 1. Factors influencing digital performance.

skills are at the core because they are transferable. It is crucial to have an overview of the possibilities of digital tools and a vision of what digital tools can be used for.

Digital culture describes the atmosphere regarding the use of digital resources, behavior, and engagement with digital developments at the university as a whole and in individual teams. Its importance, as stated by Murawski and Bick (2017) and Meyers et al. (2013), can be confirmed and is shaped by several factors. If employees perceive the university level of digital transformation as less innovative, this can inhibit their willingness to develop, whether due to a lack of incentives or perceived barriers. Skills and attitudes within the team are crucial. The more open it is, the more people follow or benefit from the pioneers and impulses within the team. In TAM3, the image created by a person's use of technology and the opinion of important people are identified as central factors in technology acceptance (Venkatesh, 2000). Managers can encourage and value training. They are responsible for negotiating a mutual understanding of communication. This is reflected in project collaboration and exchange. A positive atmosphere encourages experimentation and allows people to make mistakes and try new things. Finally, appreciation also has a significant impact—whether through resources provided or through gratitude and recognition.

With regard to conditions, these refer to resources mentioned as an important factor in TAM3 (Venkatesh & Bala, 2008). Lack of resources—whether time or money to invest in hardware or software—is the biggest reported barrier to digital performance. It is equated with a lack of appreciation. Requirements such as data protection and ethical guidelines are recognized as important when using digital tools. However, they are often so restrictive that many choose to avoid using these digital tools altogether because the use of them becomes too complicated. In-depth use of digital tools often falls victim to different teams working with different digital tools. In-depth training is then seen as having little value.

Services and empowerment are considered offerings from the university that relieve and support employees. These include, for example, contact points for questions, technical support, coaching, and training opportunities. It is important that these offerings are adapted to the limited time resources of employees. That's why they should be very situation- and person-specific. Services that reduce the workload and demands on employees help to reduce overload and remove initial barriers to using digital resources by academic staff. A similar finding by Koch and Klopfenstein (2021) shows that the demands on digital skills can be reduced if organizations create proper conditions.

An aspect that "hovers" over digital performance is *mindfulness*. Technology stress must not be underestimated. Mindfulness involves managing one's resources (both emotional and practical) and being aware of the impact of digital tools and communication (e.g., how can I manage criticism on social media? How does digital communication stress me?). Pfaffinger et al. (2023) demonstrate that mindfulness apps can help reduce stress at work.

The different dimensions are interrelated and influence each other. A person's openness is a crucial determinant of their willingness to engage with digital tools and channels and to acquire the skills to do so. This has a direct impact on digital performance and digital skills. As a team member, an individual's openness and mindfulness directly influence the digital culture, which in turn influences the individual's openness. Services and empowerment offerings partly reflect digital culture but also directly promote digital skills and can contribute to (further) openness and reduce employee anxiety. Framework conditions can potentially

support openness and digital culture but can also be restrictive and thus inhibiting. All the dimensions mentioned above—openness, culture, digital skills, framework, and services/empowerment—have an impact on digital performance. The use and experimentation with digital tools and channels can have an impact on openness and digital culture.

6. Prospects and Limitations

The model has been transformed into an assessment tool that provides a structured self-assessment of the team's digital performance. It is designed for executives and project managers to identify challenges and needs for action related to digital performance in the team. The assessment is structured according to the sub-dimensions of the model and includes statements such as:

- I have NO reservations about using digital communication and collaboration tools (openness);
- The team is regularly encouraged to try new digital communication and collaboration tools (digital culture);
- The digital tools we have available for teaching meet my needs (framework conditions);
- Employees are empowered to use new digital tools with care (self-management, empowerment);
- I know which digital communication and collaboration tools are relevant to my work (digital literacy);
- There are contacts for questions about social media activities (science communication, empowerment);
- I would like a collection of tips for working with digital tools (service requests).

A specific section deals with science communication and requests. The assessment can be completed specifically for research/advising or teaching. It's based on a 6-point Likert scale, and it's possible to indicate if an item is considered irrelevant. The next step is to test its applicability and reliability in a quantitative survey and to reduce the number of items to make it more applicable.

The assessment tool provides a means for developing awareness of, and reflection on, one's digital literacy and performance. Moreover, it includes an assessment of the organizational setting, which is crucial for employees' performance and motivation. Self-reflection is already acknowledged as a valuable method to foster the digital literacy of academics (Inamorato dos Santos et al., 2023). A crucial first step in improving the digital competence and performance of academic staff is recognizing both personal but even more organizational deficits and limitations for digital performance. Identifying potential hurdles and demotivating factors is essential, as it can prompt discussions on how organizations can better support and alleviate staff burdens. This is particularly important given that personal time constraints are a major factor limiting the advancement of digital literacy and performance. Organizations can create environments that foster skill development and alleviate competency demands by providing tailored overviews of tools and their applications in the academic context. This requires an understanding of the specific work within various disciplines. Customization of offerings by the institution is important, as training is often not at the right time or is too general. This also has been highlighted by Fernández-Morante et al. (2023). Personalization may be through field-specific contacts, discipline-specific guides, or personal training. We, therefore, recommend using the assessment tool within teams and institutes as an indicator of the position of employees to define areas for action. It creates a basis for discussion, in which weightings should be made jointly and decisions made as to where action is required.

In regards to the limitations of this article, first, designed as a case study, only one university was examined. The specific context of that institution has influenced the participants' responses. Secondly, the sample is composed exclusively of academic staff, though it is diverse due to different hierarchies and disciplines. Thirdly, the results are based on participants' self-assessments and assessments by others, without the use of concrete measurements or objective indicators. Assessments are individualized but reflect employees' perceptions. The comprehensive survey of all work and application areas is both an advantage and a limitation. For future study, it seems essential to focus on the field of science communication separately from teaching and research, as there are different prerequisites and use cases. Therefore, this aspect sometimes gets less attention in this study. It is assumed that the factors of the framework model are likely to apply to all fields of university work.

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Conflict of Interests

The authors were employed at the university under study. Their institute was not included in the research. The respondents were not personally acquainted with the authors.

Data Availability

A German version of the interview guide is available at ResearchGate. To protect the anonymity of the respondents, the interview transcripts cannot be made publicly available.

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Exploring Media Literacy Formation at the Intersection of Family, School, and Peers

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Abstract

Today, media literacy and digital skills are essential for personal communication and social interaction. Children and adolescents need these skills to act autonomously in highly digitised social contexts. These skills are acquired in different social spaces, most frequently and primarily at home, followed by peer groups, school, and extracurricular activities. The present study aims to conceptually situate media literacy within a broader network of social power relations. It is therefore grounded in an academic theoretical framework that constructs media literacy as a form of digital cultural capital. As such, media literacy also contains the principles of media preferences and choices that condition the media choices of young people. This draws our attention to the social contexts in which media literacy and digital skills of children and teenagers are formed: within the family, school, and peers. With a selective thematic analysis of qualitative interviews with 67 primary and secondary school students (12–19 years), the empirical research is focused on different contextual incentives and regulations related to the formation of students' media literacy, primarily in relation to digital media. First, we examine parenting practices that frame home access to media and media practices within families. Then, we explore the characteristics of formal media education within schools, which seems limited to teaching with/through media. Finally, we identify peer networks as important promoters of both digital capital and elements of advanced media practices and skills, compared to the media literacy encouraged within families and schools.

Keywords

digital capital; media education; media literacy; media practices; primary school students; secondary school students

1. Introduction

Today, media literacy (ML) and digital skills are essential foundations for personal communication and social interaction (Carretero et al., 2017; Hobbs, 2010). Children and adolescents need these skills to act autonomously in highly digitised social contexts. These skills are acquired in different social spaces, most frequently and primarily at home, followed by peer groups, school, and extracurricular activities. The present study aims to conceptually situate ML formation within a broader framework of social power relations that shape the various ways in which young people become media literate. This draws attention to the social contexts in which ML as digital capital of children and teenagers is formed: within the family, school, and peers. We have chosen these three spaces because socialisation mainly takes place in two phases—primary and secondary socialisation—each of which is influenced by different agents, such as family, school, and peers. With a selective thematic analysis of qualitative interviews with 67 primary and secondary school students (12–19 years), the empirical research focuses on incentives and regulations related to the formation of students' ML and their media repertoires. First, we examine parenting practices that frame home access to media and media practices within families, as the primary social context of young people's capital accumulation. Then, we explore the characteristics of formal media education within secondary school, which seems to be limited to teaching with/through media (Buckingham, 2003). Finally, we identify peer networks as potentially important promotors of ML, often introducing young people to experiences that might be beyond the scope of what is otherwise familiar to them.

2. Cognitive and Social Dimension of ML Formation

When viewed against the backdrop of a normative understanding of media, ML is a cognitive attribute, a skill that a person develops continuously (see, e.g., Potter, 2004) through media education. Media education can be more or less spontaneous, coincidental, purposeful, structured, formalised, and institutionalised, and can result in different forms of ML. In general terms, following Potter's cognitive theory of ML, it allows us to control our own exposure to media and media-mediated content and serves as the basis for constructing our own meanings (Potter, 2004, pp. 58–59). From the perspective of the individual, more ML translates to greater emancipatory potential of media consumption; that is, better access to desired content, less risk of negative effects of media consumption, and greater effectiveness in realising personal goals with and through media, e.g., in terms of being informed or entertained (Potter, 2004). However, media education, as a complex process of ML formation, transcends the cognitive dimension and is socially structured: it depends on social, cultural, political, economic, geographic, and other factors. Moreover, conceptualisations of ML, confronted with the so-called deep mediatisation (Hepp, 2019) of everyday life, are now densely intertwined with information infrastructures and media, in which new practices of everyday life, coming of age, and education are emerging alongside the ever-new technological capabilities of media (Buckingham, 2008; Livingstone, 2009; Potter, 2004).

Certain studies conceptualise contemporary youth as digital natives, thereby superficially drawing an equivalence between the ubiquity of technology and the supposedly inherent endowment of young people with the skills to use digital media (Prensky, 2011; Thomas, 2011). In fact, ML is the result of a broad and complex media education, which, in addition to formal education in educational institutions, includes media socialisation in the context of the home, participation in peer-to-peer media practices, and many other spaces of coming-of-age, whether educational in nature or otherwise. Indeed, the material access to media,

such as being equipped with a telephone or computer and having an internet connection, and so-called cognitive access, which includes digital competences in the use of digital media and technologies, are only the necessary conditions for the formation of ML and by no means sufficient conditions (see Ranieri & Fabbro, 2019).

The processual nature of ML (Potter, 2004) implies a continuous development of the critical reception and production of media messages through technology and the formation of the civic identity of young people (see also Jenkins et al., 2016; Leaning, 2017; Mihailidis, 2014; Mihailidis et al., 2014). It therefore involves the development of a wide range of skills and competences in relation to the different media, technologies, representations, symbols, and content that enable participation in public life (Buckingham, 2003; Ranieri & Fabbro, 2019), or empowerment for inclusion and equal opportunities for the contemporary youth coming of age in an intensively mediatised everyday life. Hobbs (2010, pp. vii-vii), for example, builds a conceptual link between media and digital literacy, on the one hand, and civic literacy, on the other. A related concept of critical ML is advocated by Kellner and Share (2007), who, while critically analysing information, power, and the relationships between media and audiences, propose extending ML by understanding mass communication and popular culture, as well as multiculturalism (Kellner & Share, 2005). Similarly, Ranieri and Fabbro (2019) propose a model of intercultural media education, whereby material and cognitive access to media are prerequisites for: understanding the mechanisms of the media landscape and assessing media content and the contexts in which it is produced, as well as the opportunities and constraints associated with it; developing creativity or production skills; and active participation in society through media, which in turn requires an environment of incentives for learning, self-reflection, and participation in the digitised everyday life. Critical media education therefore goes beyond the instrumentalist role of digital media and technology in education, especially when these media are predominantly used to illustrate learning content or simply to teach the use of technology as a tool, as problematised by several authors (Buckingham, 2003; Hepp, 2019; Jenkins et al., 2016; Leaning, 2017). Consequently, the present article refers to Ranieri and Fabbro's (2019) aforementioned model, focusing on the environmental factors of media education, primarily on the material accessibility of digital media and encouragements and deterrents to ML formation among family members and peers, and in schools.

3. ML as Digital Capital

As the above discussion suggests, at least implicitly, ML is always shaped in and by specific social contexts. Despite the initial promise of technology and especially the internet as great levellers of social inequalities, these contexts remain marked by asymmetrical social power relations. Notwithstanding the thesis of the end of history (Fukuyama, 2006), these power relations have not been eliminated to any significant extent by Western societies; they are still reproduced through traditional arenas of social reproduction such as the family and school, as well as through peer relationships, which, especially in young people, constitute a key source of social judgement, as analysed by Perger (2024).

The contemporary world is marked by the third industrial revolution (Castells, 2010; Rifkin, 2011), also known as the digital revolution, which designates the transition from industrial production based on mechanical and analogue technology to digital information and communication technologies, as well as deep mediatisation (Hepp, 2019). ML is becoming increasingly important for the functioning of individuals and societies, while at the same time representing a potentially new axis for the reproduction of social

inequalities. As evidenced by the various conceptualisations of the digital divide, the gap goes beyond ownership of technology and is rapidly widening in the area of digital skills, usage, and the benefits derived from digital technology, thus encompassing both material and cognitive aspects of media use (see, e.g., Šimenc, 2021). Gaps in material access to digital media and technology are particularly evident in studies regarding the conditions of ML formation in the Global South and North (Katz, 2022), which find, inter alia, that access to the internet and to devices such as computers tends to be scarcer for young people from the Global South (Livingstone, Kardefelt-Winther, & Saeed, 2019, p. 66). At the same time, as Robinson et al. (2020, p. 2) point out, the increasingly complex and interrelated nature of digital inequalities creates a so-called "digital inequalities stack," where individual levels of the stack can have an impact on other levels. In other words, digital inequalities can be understood as inequalities in access to, use of, and benefits from digital technologies, which can be manifested in various forms and often exacerbate existing social, economic, and educational inequalities.

ML and the inequalities it entails can also be understood in the context of what some authors have referred to as digital capital, drawing on the conceptualisations of capital by Pierre Bourdieu. Broadly speaking, capital is a resource that accumulates over time and can be mobilised to create specific values. Capital thus represents "the ability to exert control over one's own future and the future of others. The capital that individuals can accumulate determines their life trajectory" (Postone, 1993, pp. 4–5).

Bourdieu (2004) distinguished between economic, social, cultural, and symbolic capital. By adding other forms of capital to economic capital (monetary resources), he drew attention to the importance of cultural capital, which is primarily accumulated in the family. Cultural capital exists in three forms: in embodied form, as the permanent dispositions of an individual, their knowledge, skills, and abilities; in materialised form, as cultural heritage (e.g., paintings, books, devices); and in institutionalised form (diplomas, awards, success in competitions, etc.). Alongside these, social capital is also important, as it represents a set of contacts, acquaintances, friendships, and duties, forming relatively durable networks of relationships, and thus constitutes a central element of social ties, even if it often exists only as a potential. In this respect, Bourdieu notes that the key to understanding how capitals work is to recognise that they can be transformed into one another; for example, the economic capital of a family and the social capital of the parents are transformed into different forms of cultural capital by the children of that family, which they will be able to transform into other forms of capital in the future, e.g., through the attainment of a diploma that will give them access to a job and thus to economic capital.

Applying this conceptualisation of forms of capital to the digital world, we observe that a person who owns a computer (an economic and objectified form of capital) must have embodied cultural capital in order to use this device for a specific purpose, such as participating in online classrooms. An example of a person who owns a device and requests help with its use, e.g., from a sibling or friend, is a form of cultural and social capital unequally distributed in society. As Park (2017, p. 69) emphasises, "intangible forces of society, such as social and cultural capital, in contrast to the monetary forces that come into play in modern societies, can explain the variances in people's ability to mobilise resources to use digital technologies." If owning a device means owning cultural capital, then having someone to ask for help, someone who can provide help, represents social capital.

While we have indicated, like Ignatow and Robinson (2017), that the original concept of different forms of capital can also be applied to the study of the digital society, some researchers argue that it would make

more sense to combine all of these forms into one and discuss digital capital separately, because digital engagement always includes all of the aforementioned forms of capital. Calderón Gómez (2020) proposes a slightly different definition of digital capital "as a sub-form of cultural capital linked to the use of digital technologies and contemporary cyber culture" (p. 4). According to this definition, digital capital can be found in two distinct forms:

> First, (a) as embodied digital capital (EDC), it is internalised in the habitus by means of digital skills, dispositions, motivations, interests, expectations and past experiences that affect digital practices. Apart from digital skills, EDC also includes a vast repertory of digital cultural dispositions that constitute digital literacy….Second, (b) objectified digital capital (ODC) is materialised in digital equipment, devices and the technological infrastructure. (Calderón Gómez, 2020, pp. 4–5)

As part of digital (cultural) capital or one of its forms, ML, like other forms of capital, is produced in a socially unequal way, insofar as the accumulation of different forms of capital is always related to the individual's position in the social space. At the same time, the socially differentiated appropriation of ML—again similar to other forms of capital theorised by Bourdieu—has important implications for opportunities for the future appropriation of capital, and thus for the occupation of social positions in the future. It is precisely for this reason that the following section focuses on the identification of the different elements and building blocks of young people's ML in the three social fields that are crucial for them: family, school, and peer relations. We focus on these three social fields because they are of central importance for the accumulation of capital and the formation of the dispositions of the young person, or the formation of what Bourdieu (2002) calls habitus. The family thus represents a space of primary capital accumulation and the formation of the primary habitus of individuals. In relation to digital capital, the family regulates the primary access to digital capital in its material or objectified form (computers, internet connection, smartphones, digital platforms, videogames, apps, and computer programs), which can vary in quality of technology and sophistication (Calderón Gómez, 2020). The family is also the primary space of the accumulation of digital capital in its embodied form (from tastes in media consumption to skills in managing digital technologies and other aspects of ML), as well as being an important agent of social capital, which can provide support in digital media activities (Courtois & Verdegem, 2016).

On the other hand, the school and peers represent spaces of secondary accumulation of various forms of capital and the formation of the secondary habitus of the young person. As Bourdieu and Passeron (2000) point out, school is one of the fundamental institutions of reproducing social power relations; it represents a space for the transfer of legitimate knowledge, the kind of knowledge that is worth acquiring, including knowledge related to ML. Furthermore, school is the central space for the transfer of institutionalised cultural capital in the form of qualifications and diplomas (Bourdieu & Passeron, 2000; see also Bourdieu, 2004). With regard to ML and digital capital, schools can also provide young people with access to material digital capital, whether in the form of more specialised devices that most students might not have access to, such as 3D printers, or by providing access to more common digital resources, such as supplying computers to students without access to such resources at home. This role of schools as providers of material access can also be accompanied by the school's role in providing young people with cognitive access or embodied forms of cultural capital related to digital media, whether in the form of encouragement or discouragement to engage with digital media, or in the form of transferring specific digital media skills and knowledge to young people as part of its fundamental role in knowledge transfer.

In terms of capital, peer networks are often analysed in relation to social capital and its translation into economic or cultural capital. Furthermore, peer relationships are often analysed in terms of homophily, a principle of the formation of social ties by which we choose peers who are socially similar to us (Bottero, 2007; Lenkewitz, 2022; McPherson et al., 2001), while emphasising that peer networks can both amplify and alleviate social inequality (Basov, 2020; Lenkewitz, 2022). With regard to digital media, peers represent important agents of support in developing ML, thus also contributing to digital capital formation (Courtois & Verdegem, 2016). Research also shows that young people often use social media to extend offline relationships into the online sphere (Ito et al., 2009; Lim, 2022), while some studies (Krämer et al., 2021) demonstrate the importance of strong ties, including friendship ties, in offering online social support to young people. The online sphere also offers young people opportunities to encounter phenomena that are less known to them, as well as to engage with various learning opportunities (Krämer et al., 2021) and people who share common interests but do not necessarily align with their demographical and social position.

4. Description of the Research, Methodology, and Qualitative Data Analysis

The present study is part of a national fundamental research project entitled Media Repertoires Among the Youth: Social, Political and Cultural Aspects of Digitalised Everyday Life (J5–2564), within the framework of which our data were collected and analysed. Recruitment was conducted in two phases: primary and secondary schools were first invited to participate, and only after the school principals agreed did we contact the students and their parents to obtain their informed consent. The interviews, which mostly lasted one to two hours, were conducted in spring 2021, when interviewing students in person was not possible due to restrictions related to the Covid-19 pandemic. The focus groups were therefore adapted for online execution via the Zoom platform, which was well known to the participants, as it was also used for distance schooling. Following the recommendations of certain research on the quality conducting of focus groups by videoconferencing (Lobe & Morgan, 2020), the focus groups were conducted with a smaller number of participants, mostly with two or three people each time.

With 27 focus groups, we achieved a diverse non-random sample of 67 students aged 12–19 years from various family and school backgrounds and from different urban, suburban, and rural settings in Slovenia (see Table 1). The sampling objective was also to include students with various socio-economic backgrounds; however, with one or two exceptions, we primarily reached students from middle-class families, as recruitment was done via schools that were unable to follow the instructions due to lower interest in participation among students from lower social classes.

The questionnaire was organised into seven thematic sections: (a) memories of early media usage; (b) media practices, social networks, and technological preferences; (c) equipment, access, and regulations of technology; (d) norms and habits of media and technology practices in schools and among peers; (e) digital technology appropriation in schools; (f) media and technology use in spare time; and (g) possibilities, pressures, and aspirations. Each person participated in one focus group discussion.

As we were primarily interested in the broader context of media education and ML formation, we adopted Ranieri and Fabbro's (2019) definition of media education. In the process of analysing the data acquired in the focus groups, we concentrated on selected components of this definition that are the most crucial "environmental" factors in shaping the conditions for ML development: the material and cognitive

Table 1. Demographic background of the focus group participants.

Type of school		
Primary	40%	27
Secondary	60%	40
Total	100%	67
Gender		
Male	45%	30
Female	55%	37
Total	100%	67
Age		
12	7%	4
13	8%	5
14	14%	8
15	20%	12
16	17%	10
17	15%	9
18	15%	9
19	3%	2
Total	99%	59
Geographical setting		
Urban	68%	40
Suburban	17%	10
Rural	15%	9
Total	100%	59

accessibility of media, together with the environment and encouraging ML formation, which are the basis for all other media practices and more complex forms of ML, such as critical and analytical media reading skills or participation through media. We will therefore analyse in more detail: (a) the family context (technological or media access at home, media practices, use of technology, and transfer of digital media skills within the family); (b) the experience of students in the classroom (accessibility and regulation of technology, digital, and ML in the school context); and (c) the peer setting (role models in terms of technological literacy and behaviour with and through media).

Thematic coding was conducted in two steps. It was first approached in an unstructured manner without predefined codes (Corbin & Strauss, 1990; Glaser & Strauss, 2017), focusing on the three thematic strands mentioned above in relation to the underlying conditions and broader contexts of ML formation within families, school, and peers. In the next step, the axial coding phase, the analysis was narrowed to codes and categories that offer insights into the material and cognitive access and (dis)inclinations or incentives for ML within the family, school, and peer groups, which are essential elements of the formative environment of ML, as evidenced in the analysis (see code categories 8, 11, and 12 in Table 2).

Table 2. Code/category occurrence for environmental factors shaping ML.

Code/category no.	Code/category name	Code/category occurrence
8	Incentives for media education and participation	421
8-A	Family	234
8-B	School	96
8-C	Peers	91
11	Cognitive access, use of media and technology, self-reporting on their own skills and those of important others	841
12	Material access at home, in school, via friends or peers	324

Note: Code/category occurrence is the sum of all quotes marked with the code or category, whereby the same quote may be marked with multiple codes, including those within the same category.

5. Findings

5.1. Family and Different Forms of Incentives as Building Blocks for Young People's ML

Material access to media is fundamental for the development of ML. Our respondents report that they do not experience any problems in this respect. Most of them have a computer in their room and own a smartphone. It is worth noting that, especially for the participating primary school pupils, the computer was often introduced into children's rooms with the onset of the pandemic and the introduction of distance schooling, or was present only in exceptional cases, such as with gamers: "I have a computer and a phone, and now that my brother isn't really interested in the Nintendo Switch we bought together, I have it in my room" (GR, male, 15, primary school). As mentioned above, material and cognitive access should also be read against the backdrop of parents' various approaches to media regulation. On the one hand, this includes their positive reactions to media, facilitating conversations about media and their use, and guiding young people through the mediatised landscape; on the other hand, it comprises more restrictive approaches, such as focusing primarily on parental control, which may be related to the time children spend on social media or the content they follow.

The interviews revealed frequent restrictive practices by parents, which are usually linked to rules limiting the time spent on media and bans on the use of a device or its confiscation if school performance deteriorates: "Um, in my family, my mum sets these rules…and…during the week, Monday to Thursday, I can use my phone until nine o'clock, but at the weekend I can use it as much as I want, um" (DA, male, 14, primary school). Parents occasionally show interest in the media content in which their children are interested and discuss the content with their children. Most of the time, however, adolescents report that their parents trust them and do not restrict them too much: "This used to be the rule with social media, my mum knows which apps I have because I talk to her about this, but she doesn't really care because she knows that I won't do anything wrong" (ZA, female, 14, primary school).

The participants rated their parents' digital skills and mastery of digital devices as relatively good, typically attributing their digital skills to their use of a computer for work, as was noted by ZA (female, 14, primary school): "My mum, I mean…my mum uses computers at work, for the whole day, actually…so she's good with email and stuff…she can also type really fast."

The interviewees remarked on various instances when they turn to their parents for support related to media use, as in the case of AN (female, 18, secondary school): "Yeah, my dad has to know a lot because of his job. So he's definitely the one that taught me the basics, he also helps me with computers."

The students further differentiate between the skills of their fathers and mothers, often seeing themselves as the ones who are more skilled on telephones and social media: "They don't, because I don't think they know enough about these things [social media], it's more that I warn them" (LI, female, 18, secondary school).

5.2. School as a Space of Formal ML Formation

As in reading or mathematical literacy, education can play an extremely important role when it comes to ML formation. Its role can be twofold: it can contribute to enhancing cognitive access, while it should also compensate for a lack of material access to media or devices, in line with its fundamental task of reducing social and economic inequalities and their impact on students' academic performance. Although one participant mentioned that the school lends computer equipment to disadvantaged students, the school's role in bridging material inaccessibility remains not mentioned in our interviews.

Young people's experience of school and media skills is also quite modest in relation to cognitive access. Indeed, the responses of our interviewees show a distinct instrumentalist understanding of media and technologies in Slovenian education. With rare exceptions, the statements of our interviewees suggest that media in schools are mainly used as convenient tools, e.g., to implement the learning process remotely through videoconferencing systems and online classrooms, to test knowledge through online quizzes, to present or deliver material using a computer projector or an electronic whiteboard, or to illustrate learning content and enrich the classroom by using interactive textbooks and showing videos instead of conducting experiments in the classroom: "Um, I mean, the teacher just says, like, go to the virtual classrooms, I left you something in there, go and have a look. Something like that, or we Google something" (MJ, male, 17, secondary school).

Apart from education through media, primary schools rarely offer media and technology education. When they do, it is mostly limited to workshops on online safety awareness and, judging by some of the participants' statements, is considered redundant: "It's kind of pointless because they all keep saying the same thing. Almost the same thing year after year" (SV, female, 15, primary school).

Another prominent feature in the school context is the strict regulation of access to digital technology, which translates to a ban on phone use during classes and recess, or even the presence of phones in the classroom:

> And, that's why we have this box, so that when we come to school, we all put our phones in the box and halfway through the main break, that is, an hour before the end of school, you can take your phone, but you have to put it in your school bag. (SN, female, 14, primary school)

The smartphone, which can be a useful learning tool, a tool for finding information, or a calculator, is thus most often labelled as a distraction from the educational process in the context of education. The attitude to the use of media and technology in students' school work outside regular school hours is somewhat more liberal. It is then that the phone is more often used as a learning tool to find resources for school assignments,

or as a platform to organise class groups for learning or for informing and consulting classmates through social networks and other applications:

> Um, well, we have this Facebook group where there are a few students from my school and sometimes we post things about test and such….Yeah, well, we usually get on a call, and, well, we do things together. I mean, if someone needs help. (JE, male, 17, secondary school)

5.3. Classmates, Friends, Peers: Interactions, Expectations, and Encounters With the Undomesticated

Contrary to frequent public laments about young people not socialising enough and spending too much online, our interviewees are keen on using social media to socialise and communicate, and it is these activities that our respondents most often highlighted in the context of their media routine. They typically use several different social media networks, with Snapchat, Instagram, TikTok, and Viber being the most common. Messaging is limited to a small circle with whom they also have face-to-face contact. It is worth pointing out, however, that young people differentiate both content and, at least to some extent, social networks according to the closeness of their relationships or the strength of the social ties that bind them. JA (male, 12, primary school) elaborates on this point as follows:

> I use Viber mostly to talk to my classmates in our Viber group….I only use Snapchat to talk to my friends. There are rarely people I don't know in person, just people who I met first and then we started talking on Snapchat.

Social media groups were particularly often used to chat with classmates, and have an explicitly instrumental role in young people's lives: "Yeah, I use Snapchat for school the most, because, umm….I talk to my classmates there, if I need something" (BO, female, 15, secondary school).

School tasks are far from the only topic of online discussion among peers. Our interviews also indicate the role media play in sharing common interests and developing peer-sanctioned tastes. Hence, the practices of recommending and discussing a variety of media content—from TV series and films to news and books—are also relatively frequent topics in the interviews:

> Then, like, I mean, right now, depending on when I get that book from my classmate, which I'm waiting for, but otherwise, if I had enough time, I could actually read it really fast. It depends on how thick it is, of course. (VI, female, 13, primary school)

> Mmm, I saw, about a year ago, Riverdale, when people were talking about it. Um…currently, as my friends suggested, I'm watching a series called Blacklist, because I'm interested in it, and I like that kind of content, so, yeah. (JE, male, 17, secondary school)

Peer incentives are also important when it comes to sharing information, as peer networks can act as a source of access to information as well as a potential topic of conversation with peers, which has particularly important implications for the promotion of ML, especially when it relates to seeking information and attitudes towards socio-political developments, which are mainly encountered online:

> Basically, it seems to me that it's always more important to be informed, because if you're not informed, you're basically kind of out of society, because everyone is talking about current affairs and then you have no idea what they're talking about, you're just in the back listening and not taking part. (TK, male, 17, secondary school)

It is worth mentioning a few practices that can make an important contribution to building ML in the context of peer interactions. While the aforementioned incentives are mainly related to peers with whom young people typically meet in person, peer incentives can also include recommendations from those with whom young people share not only physical or age proximity, but also, and above all, a proximity of common interests. This is particularly true for video game and technology enthusiasts, although these interactions also expose young people to other content, such as books and educational and other content related to various aspects of their lives:

> Uh, mostly on YouTube, like the person before me mentioned—a Canadian YouTuber who builds computers. Linus Tech Tips? Yeah, I watch him. Uh…he talks about, you know, the latest tech news happening around the world….And he explains how things work and stuff. Uh….Then I also watch this electrician, he's basically an Indian guy. And, like, he shows things in a funny way, you know….Uh….And lately, I've been watching a lot of smartphone news. I mean….I'm into it, so (shrugs), it's fun to watch. (HE, male, 17, secondary school)

> So on YouTube, um, well, I, um, I like to read, so I know of this English or American girl, she's, um, older than me but still a teenager, or how should I put it….And she creates content related to books, and she makes videos….And she recommends books or, like, books she's read, tells the story, and then, like, if she likes the book….And I would read it….And so I have some ideas…(PI, female, 14, primary school)

In these types of peer interactions, the interviewees were generally passive, undertaking activities in which they primarily follow the content and do not respond to it, by leaving a comment or like, for instance.

6. Discussion

As our conversations with young people show, the social contexts in which they develop ML and digital capital in general are diverse. The family environment is characterised by a duality of affection and concern regarding media practices. The latter relates to the content that young people consume (or share) and the amount of time they spend with media, both of which are responded to by parents through more or less restrictive regulation of media consumption, with family patterns of regulation changing in parallel with changes in young people's media practices. As found in a study by Yuen et al. (2018, p. 10), parental digital competence and parental care (support, regulation) also stand out in the context of family incentives in the present study, confirming the aforementioned importance of strong ties (Krämer et al., 2021) in young people's ML formation. Our sample consists mainly of families with a higher socioeconomic status, which means that the parents of the interviewees have completed tertiary education and are digitally competent, as required by the work they do. They are therefore able to help their children with their use of technology and allow them considerable freedom in their media practices, but not without regulative interventions. In comparison, Livingstone and Sefton-Green (2016) tracked patterns of technology regulation in British

families: on one hand, it stems from competition and a desire for a better future for children, which drives parental support for digital skills acquisition; while, on the other hand, it is derived from conservatism, which is manifested as resistance to social change and disconnection from the digital. However, as Ignatow and Robinson (2017) warn in their analysis of existing Bourdieusian research on digitalisation, such parenting practices should not be generalised, and it would be worthwhile examining the extent to which different families encourage various forms of engagement with digital media in the Slovenian context.

With regard to the promotion of media practices, the school environment can be characterised as modest, especially when compared to the context of family and peer groups. ML, which, like other literacies, could reasonably be expected to find a place in schools, is present there mainly in the aspects identified above as technicist, consisting primarily of instructions on how to handle computers and corresponding to some aspects of cognitive access (Ranieri & Fabbro, 2019) to digital media. In this respect, the existing incentives reported by our respondents suggest that media education in schools occurs on a basic level, such as the use of dominant text editing computer programs or screening educational videos. The respondents also highlighted awareness about internet safety, which is typically taught in workshops run for schools by external organisations. This can be understood as another aspect of ML related to online privacy and safety, which schools promote within media education for the accessibility of media and technology that focuses on providing the fundamental knowledge that is a "necessary, still not sufficient, condition for media literacy" (Ranieri & Fabbro, 2019, p. 57).

Regarding media use in schools, our interviews confirm the findings of the international PISA survey, which measured students' digital skills in 2018. According to recent data (OECD, 2021), Slovenian students use media at school for an average of 23 minutes per week, compared to the OECD average of 41 minutes per week. Although, on average, aspects of ML are less present in Slovenian schools than in other OECD countries (OECD, 2021), Slovenian youth are more likely than their OECD peers to deal with harmful content (spam, phishing) and issues related to the consequences of disclosing personal data online (OECD, 2021). Concerns about the latter were also evident in the interviews with our respondents, who often reported not posting their personal data and photos, and generally having restricted access to their social media profiles, giving them more control over who can access their content. Given the social trends associated with digitalisation, it thus seems that education in Slovenia is missing out on opportunities to equip young people with ML and thus to reduce the inequalities that are in one way or another associated with ML and more broadly with digital capital (see Robinson et al., 2020). Moreover, Slovenian schools seem to miss the opportunity to promote material access (Ranieri & Fabbro, 2019) to digital media and technology and only bridge the digital divide on the material level to a lesser degree. Even though schools are mostly well equipped with broadband internet connectivity and digital devices, they seem to rarely incentivise the use of these technologies among students (limited access to computer classrooms) and they only rarely lend devices to students with lower socio-economic backgrounds.

The peer incentives of young people can perhaps be described as the most varied and dynamic, which is not surprising given the deep mediatisation of their lives and the importance they place on peer contact. Peer networks enable young people to accumulate social capital in both of the senses usually attributed to it: as bonding within a group and as a means of bridging distances between groups (see Putnam, 2000). In other words, media-based peer practices allow individuals to deepen their connections with people they already interact with in person, while also enabling young people to bridge distances and access remote groups, experiences, and information they might not otherwise encounter. The present research confirms that young people use media as digital capital in both ways. They report using social media to interact and

strengthen their ties with their offline peers, and it is through these ties that they can access sources of cultural capital, such as content suggestions and information about current affairs, as well as dispositions towards content and tastes. In this sense, it appears that peers can have an important supportive role in the formation of different aspects of ML formation, such as enabling cognitive access through content recommendations or information sharing (see also Courtois & Verdegem, 2016). However, this further raises the question of the extent to which these types of social practices contribute to solidifying existing social norms, tastes, and media practices, as well as the extent to which they contribute to expanding or transgressing them. Moreover, there is no assurance that the content and information shared is of high quality; on the contrary, it can potentially be harmful, as research has shown (Livingstone, Kirwil, et al., 2014). Nonetheless, this can still be part of the individual's ML and digital capital profile. The present research also raises certain questions related to young people's experience of and relationships with online content creators. As seen above, young people follow various online content creators, influencers, and stars, in relation to whom they shop, shape their preferences, learn new skills, or follow current affairs, inter alia. These relationships are often termed parasocial relationships, possibly because they appear to lack the two-way nature of what is commonly believed to be a relationship. However, young people do indeed form relationships with these creators or influencers, which can range from simply following their social media accounts and liking their posts, to other levels of engagement, such as commenting, subscribing, and joining discord servers or communities on forums like Reddit. These relationships present potential sources of social capital that can then be transformed into cultural capital, including aspects of ML, e.g., by gaining book recommendations or learning how different things work. While these types of relationships can indeed create problems, they can, as our and other research shows, also offer support and knowledge (see, e.g., Tukachinsky et al., 2020; Woznicki et al., 2021), which can often transcend the support and knowledge otherwise present in the individual's life. At least some of these types of relationships can be classified as "weak ties" (see Granovetter, 1973), i.e., a connection between individuals who are not closely, intimately bonded. Despite being less intimate, these weak ties can play a crucial role in individuals' lives, offering access to broader communities, information, and experiences.

At this point, we must also highlight certain peculiarities and limitations of the present study. First, even though the sample is diverse (students from different regions and from distinct urban, suburban, and rural environments), it is also biased regarding the socio-economic backgrounds of the participants, who mostly come from socioeconomically privileged families with better (than the national average) educated parents. In addition, the focus groups were conducted online during pandemic lockdowns, not face-to-face, which might have contributed to at least slightly limited insight into the participants' responses during the interviews. Furthermore, due to the impact of the pandemic on young people's media practices (see, e.g., Črnič & Švab, 2020; Jones et al., 2021; Mælan et al., 2021), we can assume that pre-pandemic media practices were different, more regulated, and less important for maintaining peer contact. Moreover, experiences with media and technology were limited in schools before the epidemic, whereas during remote schooling, digital media became a tool through which education took place. Therefore, the potential effects of the pandemic on media practices of today's youth should not be overlooked.

7. Conclusion

In the present article, we attempted to highlight the multifaceted nature of ML formation among young people in Slovenia, which is shaped by diverse social contexts, such as the family, school, and peer

relationships. Families play a crucial role in primary technological domestication as well as in balancing freedom and regulation regarding media practices. However, our research does not provide insight into variations related to media regulation in families that occupy different social positions. As perceived by our interviewees, schools tend to provide only basic media education, primarily focused on technical skills and internet safety, adopting a predominantly instrumentalist integration of media content and technologies into the educational process (Buckingham, 2003; Buckingham et al., 2001; Jenkins et al., 2016), while missing opportunities to foster a more comprehensive understanding of ML. In contrast, peer interactions prove to be a dynamic space for developing both social and digital capital, allowing young people to strengthen relationships and gain access to new information and cultural resources. The influence of parasocial relationships with online creators further expands the ML landscape, offering both opportunities for learning and challenges related to the quality of shared information. Our findings underscore the importance of considering these varied influences when discussing young people's ML, and suggest that future research should further explore how it is impacted by different social positions. In addition, future research might benefit from further studying the ways in which media are changing the structure of the individual's social ties and networks, and the implications of this for producing, reproducing, and potentially transforming social relations.

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Conflict of Interests

The authors declare no conflict of interests.

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ARTICLE

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Strengthening Responsible Journalism Through Self-Efficacious Learning-Oriented Media Literacy Interventions

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Abstract

This article investigates the challenges journalism professionals face in a rapidly changing digital media environment, proposing that a "processual" and human-centered perspective might offer valuable insights into developing resilient professionalism. The article builds its argument on theories of transmediality and hybridization in digital media ecosystems and the socio-psychological development toward accountable communication and responsible professionalism. It specifically looks at future journalists as active learners to whom media literacy interventions may offer new insights into the mental processes in professional decision-making. It tests these ideas in an experimental study with journalism students, where the lateral reading approach was applied within the framework of learning skills for information verification. Results from the thematic analysis of students' reflexive assessments of their practice reveal norms illustrative of a self-efficacious learning process: Students' answers demonstrate empowering and perseverance-directed approaches. As argued, these norms are geared toward imposing a higher media awareness and self-regulatory capacity, which is critical for accountable decision-making in transmedial and highly interactive digital information environments.

Keywords

digital media; disinformation; information verification; journalism education; lateral reading; media literacy; self-efficacy; resilience

1. Introduction and Background

Rapidly evolving digital media ecosystems with increased information abundance and greater accessibility require appropriate responses from media education methods. Despite the growth of various analyses,

there is a lack of understanding as to how informed media use and information verification take place, which specific factors influence people's decision-making, and the particular norms that guide information processing and self-efficacious learning progress. Some research-informed analyses advocate for taking a macro-focused approach, particularly a communication rights perspective framed by a digital innovations context, and exploring the implications of increased accessibility to and greater pluralization of all available information (Ala-Fossi et al., 2019; Horowitz et al., 2024). Other analyses look into individual characteristics, such as cognitive biases and reasoning failures influenced by various motivations that determine information selections and choices, shaping the opinions of individuals and groups (Poier & Suchanek, 2024). Still, as suggested by most recent insights (see, for example, Bolin, 2023), there is a lack of combined approaches that would, in their analyses, retain a technological focus and digital media affordances perspective, while also considering socio-psychological features of information selection, making of meanings, and opinion formation.

Media literacy-focused interventions are often seen as a significant means of assisting users in informed media use. There are initiatives that evaluate programs to improve media literacy and digital skills. These studies investigate interventions centered around media literacy to assist users in responsible consumption of digital content (Paciello et al., 2023; van Zoonen et al., 2024). However, evidence that links interventions around different types of media literacy and digital skills for different types of outcomes is severely underdeveloped. In other words, there is a lack of analyses of interventions to provide specific skills to various groups, including information verification strategies aimed at fostering greater media awareness among media professionals (editors, journalists, fact-checkers) themselves.

Media professionals are a unique group of lifelong learners among all digital media users. Professional journalists and editors are well-equipped with skills belonging to the profession, and yet they must continuously acquire new skills to adapt to changing technologies and media context developments, as well as respond to changing audience needs. Despite the increasing demand, there is a scarcity of theorization on how, for example, journalism education should address the rising challenges in the profession to become more attentive and responsive to audience needs and whether media literacy methodologies can be applied in educational settings for training future journalists.

This article takes a "processual" approach and discusses the experimental study in which the responses of journalism students were gathered within a specific learning context, focusing on their development as future professionals and lifelong learners. Though equipped with strategic professional functions and roles, journalists must also be seen as media users who must understand and have adequate capabilities to deal with their own biases and uncertainties. The working hypothesis was formulated in such a way that the more journalists are aware of their self-conscious thinking during the working process, the better they will be able to meet the needs of other media users. Hence, it is crucial to explore whether and how journalism education can include media literacy strategies to prepare future media professionals in response to new calls for the profession to become more attentive, inclusive, and collaborative.

The article starts by establishing a theoretical basis for journalism education by grounding it in a normative and socio-constructive strategy, which adopts a journalistic capabilities enhancement approach combined with recent theorizing on hybridization and transmediality in digital media ecologies and socio-psychological backing of self-efficacious development of responsible and resilient professionalism. This grounding, which

later refers to a pilot experiment where media literacy-focused interventions on enhancing self-efficacious learning were tested with 60 third-year journalism students, identifies avenues for extending ideas of responsible communication to be explored empirically in other educational settings.

2. Theoretical Framework

The theoretical framework utilized here combines specific strands, namely the perspective on hybridity and the circulation of digital content as well as the socio-psychological view on decision-making in contemporary digitally mediated ecosystems.

The proposed approach considers journalists working in digital media ecosystems as "mediatized" actors (Bolin, 2023; Kantola, 2014; Papacharissi, 2014), whose decision-making is pressured by infrastructural powers central to digital platform economics (Helberger, 2020; Mansell, 2023; van Dijck, 2020, 2021). These technological powers also shape hybridity and transmedial production (Chadwick, 2013; Jenkins, 2006; Papacharissi, 2014), and they act in tandem with the socio-psychological factors of individuals influencing meaning-making and the development of professional roles.

Following such an approach, in the digital media ecosystem, applying standard journalistic professional techniques, such as verifying information and reporting, does not simply equate to the sum of applied digital practices and included facts. Instead, as vividly suggested by a number of analysts for some time now, among them Jenkins (2006) and Papacharissi (2014), the concepts of transmedia production and emerging "affective news streams" are connected to multilayered features of digital information that include subjective experiences, opinions, and emotions. In other words, in digital environments, the outcomes of journalistic production must also be analyzed as stemming from internal negotiations between the assessment of digital media affordances and the ideals of responsible professionalism, combined with strategies required to verify and manage digitally sustained, opinionated discourse and ongoing self-assessment.

2.1. The Digital Media Ecosystem as a Polyvocal Scene: The Search for Journalism's Place

Digital communication infrastructures and expanding technological solutions, such as algorithmically managed data streams and AI-supported programming opportunities, create robust prospects for public expressionism in mediated discourses. However, despite the increasing trend of accessibility and content plurality, there are significant uncertainties regarding the credibility of circulating information and formed opinions. The marked increase of unverified and manipulative content, as well as the rise of dysfunctional communication forms, such as conflicts, discourse radicalization, and hate speech, are among the most evident ills of contemporary life in social media (Van Aelst et al., 2017; Yarchi et al., 2021).

For these reasons, I suggest that considering the complexity of the digital environment is critically significant in finding applicable solutions in media education. Digitally sustained media ecosystems should no longer be conceived as static systems but as fluid technological infrastructures that sustain socio-cultural networks of mediatized actors engaged in complex decision-making relationships. In most cases, these relationships are not well developed, nor are they based on clear structures and well-understood principles. Conversely, the exchanges between the content in the media, personal decision-making processes, and opinion formation are based on the interplay among several interactive systems, each of which has its own internal logic. On the

one hand, there is a system of digital media discourse that frames events and presents information in some contextual meaning. On the other hand, there are individuals who interact and actively use media to construct their own personal meanings about public events and issues. There is also a third layer, the algorithmic logic of attention management and information circulations, but in the current analysis, this digital-technological aspect of the political economy of global platforms will be less weighty.

Not only media professionals but all information users have been experiencing a consistent feeling of information overload and information exhaustion in recent years, popularly known as "knowledge resistance" (Strömbäck et al., 2022). The demand for information has dramatically increased, and information supply and consumption accelerated, especially during the years of the Covid-19 pandemic. During times of crisis and escalating existential threats, the importance of obtaining timely and accurate news increases. However, it also becomes susceptible to exploitation. As recent examples show, the influx of questionable content, conspiracies, strategic manipulations, and disinformation have culminated with the occurrence of Russian aggression and war in Ukraine, further increasing the need for people to "control" information in relation to growing geopolitical, economic, and environmental uncertainties. People of all age groups have begun using unmoderated platforms (such as Telegram channels) to get a sense of immediate news. These adapted media practices have made it easier for people to have access to crucial information and be confident in the content's reliability.

In a fluid information landscape, where different groups and interests compete for attention, conventional news media and journalism, along with the public's self-conscious awareness of multiple forms of dysfunctional content (such as disinformation, radicalism, and hate speech), are crucial for self-protection and for building resilience against disruptions and conflicts caused by manipulations and polarization (Boulianne et al., 2022; Tenove et al., 2018). However, in the context of political and social quarrels, journalists are increasingly faced with professional dilemmas regarding how to cover conflicting topics that bring together the positions of various groups in society. These challenges have been particularly accentuated in the wake of the Covid-19 pandemic: The surge of people into the digital media field as content consumers and content creators has posed new challenges for professional news organizations. As a result of this increase in communicating actors with diverging interests, journalists find it increasingly difficult to apply traditional journalistic principles in their coverage of polarizing issues. Furthermore, to contribute to general well-being, when many contested issues are on the agenda and attract diverging interests, journalists must also be aware that they are "mediatized actors"; they must recognize their own biases in information selection.

All of this suggests that the role of the media also needs to be reconsidered in times of polarization, with the suggestion that there should be a greater focus on the "views synthesizing" function. Such an approach, however, is not without consequences. Reporting and exposure to conflict-prone issues in traditional news media generates growing distrust among certain groups, further eroding their trust in conventional institutions. Journalists must implement new strategies to reduce the proliferation of alternative interpretations in peripheral and radical channels. For example, to rebuild trust in the media, a stronger emphasis must be put on journalism's communicative and even dialogic aspects (Harambam, 2021; Wasserman, 2015). This involves implementing structural changes and internal reorganizations in newsrooms by engaging with audience groups, explaining the specifics of journalistic work, and discussing journalism's role through fact-checking and information verification operations.

The literature on training strategies assisting journalists with reaching out to the public and dealing with complex, profoundly polarizing issues is gradually gaining visibility. In all such cases, a traditional understanding of newsworthiness guides journalists; however, specialized knowledge is needed on topics where different value propositions clash to avoid superficiality and the automatic delegitimization of the topic (Robbins & Wheatley, 2021). Furthermore, in response to the need for journalism to become more attentive, various forms of socially accountable journalism are also on the rise, including finding alternative solutions to current journalistic practices, such as focusing on solutions and engagement to strengthen communities (Robinson, 2017; Wenzel & Nelson, 2020) or promoting reorientations of journalism toward being more conciliatory, which means engaging in conflict mediation and online moderation (Hautakangas & Ahva, 2018). In all those cases, the professional self-understanding of the social responsibility of journalism plays a crucial role, which, from an educational perspective, is challenging to train.

One of the proposals addressed in this article is that, in various complex situations, media literacy interventions can be beneficial in assisting learners (current students and future journalists) in meeting the profession's needs. One area where advancement is evident is using media literacy interventions to combat disinformation and misinformation. The analyses that explore the outcomes and changed behaviors are especially revealing (Vraga et al., 2021). Still, what appears to be missing is the explanatory framework of advancement from one's point of view, and in such cases, "self-efficacious" learning could be seen as providing the needed mental framework to resist the potentially detrimental effects of information selection.

While a great deal of research has explored an individual's media literacy as a factor that determines their vulnerability to disruptive content (Graham, 2021; Hoggan-Kloubert et al., 2023; Tække & Paulsen, 2021), one often overlooked aspect involves the connection between epistemic factors of the learning process, such as acquired knowledge, and socio-psychological elements, including individual, agency-related aspects like self-efficacy, intentionality, and trust (Hendrickx, 2022; Paciello et al., 2023; van Zoonen et al., 2024). As will be shown in the following sections, these latter capacities are vital in the development of digital civics features among all media users (Dahlgren, 2006; Mihailidis & Viotty, 2017) and in promoting self-conscious reasoning among journalists (Eldridge & Steel, 2016), ultimately contributing to accountable and resilient professionalism.

2.2. Towards Informed Media Use: Focusing on Self-Aware Development

One of the main questions media educators are exploring in digital media ecosystems is how "informed media use" takes place and how resilience is developed.

To address all the specificities of informed media use, a process-oriented approach—defined here as "processual"—based on decision-making and self-conscious awareness development, must be considered.

As revealed, with information choices increasing in digital information environments, people must become highly selective when deciding on what media and content to focus (Strömbäck et al., 2022). The more selective they have to be, the more critical their abilities, motivations, and capacities to act and self-regulate those actions (and to sustain their self-efficacy development) will become. The more significant people's motivations and skills become, the greater the differences in media choice and information use will become.

The above process directly illustrates the complexity of socio-psychological dependencies in highly accessible and inclusive digital media environments. Individual reactions based on various factors, such as available prior knowledge and likely motivations, directly influence media access and response variations. Indeed, media literacy analysts have spent long hours testing various theoretical models to give media users greater control over complex information selections. One such scholar is James W. Potter, whose approach employing the "locus of control" framework seems to align with the self-efficacious approach (Potter, 2004). While "locus of control" directs attention to the media user's needs, "self-efficacious learning" provides an explanatory framework for developing strategically focused regulatory capacities, such as an active internal dialogue, when the received information is critically weighed, as well as the significance of developing (moral) awareness of choices in the decision-making process.

All of the above discussion suggests that resilience development must prioritize cultivating the capacity to respond to potential threats and harms by fostering critical thinking and cognitive skills, as well as a self-conscious understanding of the processes of knowledge acquisition and interpretation (Tenove et al., 2018). In digital environments, accessing information requires a user's input (Bolin, 2023), which means that people's digital actions and information choices are determined not only by their background knowledge but also by their cognitive biases and beliefs. When confronted with conflicting information or opinions, individuals experience psychological discomfort or dissonance (Sheffer et al., 2022). To reduce this dissonance and avoid being constrained by existing thought patterns, they may adjust their views or seek information that aligns with their prior beliefs. Journalists must also be aware of these challenges. For example, fact-checkers must be mindful of their immediate selections to prioritize tracking specific information in certain sources while disregarding other harmful content.

In the realm of journalism education, the development of self-efficacious learning must be foreseen as a socio-constructivist process that progresses by enhancing an individual's awareness of their own learning and the principles of professional communication. Professional thinking and (ethical) decision-making cannot be prescribed or predicted. Journalism students should develop these capabilities during (ethical and moral) deliberation and value clarification moments when performing regular information selection tasks, just as individual citizens do. The difference for journalists is that they follow professional routines, but they still may be influenced by their existing beliefs, especially if they are unaware of them.

The feature of "self-efficacy" is particularly significant here, as it determines human agency characteristics as defined by Bandura (1991, 2006). It refers to an individual's belief in their ability to make informed and ethical decisions based on the available information. A related concept—often referred to as "epistemic agency"—talks about individual capabilities that primarily relate to the critical assessment of received facts. Hence, the process of information verification (and fact-checking as a specific genre to counter disinformation) must be seen as a cognitive, motivational, and emotional practice that involves verifying, judging, and decision-making based on the received information and recognized learning features. Once again, this reminds us that information processing is a multisided, personal, and emancipation-framed process. Moreover, interacting with information is a socially defined process that fosters feelings of attachment and security, which can also be defined in a professional context. Overall, the agentive features serve as foundational elements in developing professional resilience.

All in all, human agency is constituted by one's capacity and responsiveness to reality by adjusting one's behavior considering the evaluative judgments made by one's practical reasoning. If we contend that agency is the capacity to make decisions based on one's personal judgments (knowledge), beliefs, and values and to respond to digitally mediated situations, then it is critically significant to assess how people reflect on such a capacity. In other words, the question is whether people feel empowered by the surrounding media-rich reality and motivated to participate and act responsibly (not only responsively!) in mediated circumstances, or, on the contrary, they feel deprived.

What appears crucial to understand is that attentiveness to the self-aware development of professional media actors—editors, journalists, fact-checkers—is essential in all discussions about an informed citizenship. Apart from personal engagement with content and understanding digital threats, media professionals need to consider the overall circumstances and digital information ecosystem, including the sustainability and credibility of news media and groups of professionals (editors, journalists, fact-checkers) as playing a significant role in determining the quality of people's digital interactions. To ensure quality, journalists must see themselves as self-conscious agents. Self-conscious progress runs on "self-efficacy," which, in social psychology and learning situations, refers to confidence and the ability to "control" one's motivation, behavior, performance, and responses to the social environment (Bandura, 1991). In news production scenarios, controlling individual responses refers to a self-regulatory capacity that grows within high-quality learning settings (Bandura, 2006) and has the potential to be applied to real-life professional situations later on. These capacities play a vital role in journalistic decision-making, particularly in new and challenging situations in social media, when decisions must be made based on previous experiences and acquired knowledge on whom and what to trust.

3. Case Study and Methods

Journalistic professional development and daily practices are framed within specific politico-economic and social contexts determined by structural and cultural features. Likewise, journalistic culture resembles the values and norms of a general societal culture, and its professional features are shaped by a particular country's media governance, media research traditions, public awareness, and trust in the media and education institutions (Gross, 2023). The dominant media culture also shapes the responses and views of people. Available research analyses also reveal that country-specific political, economic, and media settings significantly impact citizens' capabilities to deal with and resist information disruptions, specifically disinformation. Increasing societal polarization and rising populism, as well as low confidence in news media, limit citizens' resilience to manipulative content and disinformation. Furthermore, a weak public service broadcaster and fragmented audiences exacerbate the issue (Humprecht et al., 2020, 2021).

In this section, I will provide the practical ideas testing model by giving a brief overview of the general situation of combatting disinformation in Lithuania. I will address a few significant features of general policymaking, news media responses to disinformation, and audience awareness of the issue. After that, I will proceed with explaining how the actual training sessions with journalism students were organized to test and reflect on selected media literacy interventions.

3.1. Lithuania: Country Specificities

Lithuania is a small country on the northeastern coast of the Baltic Sea, with a population of 2.8 million. Lithuania, as well as the other two Baltic countries, Latvia and Estonia, have been targets of Russian propaganda for many decades. The Cold War ended, independence was regained, and the three Baltic countries joined the European Union, but the Kremlin disinformation machine continued to target these countries. The media policy in all three countries reveals high alertness to disinformation (Balčytienė et al., 2024). Furthermore, state institutions actively promote regional institutional cooperation, and in recent years, adequate regulatory solutions have been developed to counteract its detrimental effects (see, for example, Bleyer-Simon et al., 2024). In Lithuania, the media scene is viable, though it still faces enduring challenges in ensuring high-quality media operations in a small state. In the linguistically restricted media market, the concentration of media ownership appears unavoidable, posing significant challenges to the autonomy and survival of predominantly small regional and community media outlets (Balčytienė & Jastramskis, 2023; Jastramskis & Balčytienė, 2024). Though the number of professional fact-checking journalists remains small, in Lithuania three media newsrooms are signatories of the International Fact-Checking Network codes and highly engaged in fact-checking operations. Many reporters also foresee that being active in media education initiatives must be considered a significant professional responsibility (Jastramskis et al., 2024). Still, despite the growing concern about the detrimental effects of disinformation, the general population's ability to spot and verify online sources yields some worries. One of the Eurostat surveys shows that only 1 out of 10 Lithuanians opted to check suspicious online information ("How many people," 2021), and this result is despite the fact that many of them are confident in their skills to identify disinformation. Eurobarometer surveys suggest that people in the Baltics are more often confronted with disinformation than in other European countries, and close to 60% of respondents boldly acknowledge that they are confident in their ability to recognize disinformation (Eurobarometer, 2022).

3.2. Journalism Training Arrangements

The research question for the study was defined broadly, focusing on creating learning conditions and practices that promote self-awareness and the responsible development of participants. The study was arranged to examine self-efficacious learning features and the norms young professionals express when working on specific tasks designed with media literacy aims. An additional aspect covered the analysis of how these could assist in developing an understanding of responsible journalism.

Sixty third-year journalism students participated in the study. Students had one three-hour session per week throughout the semester, initially structured as a mentored workshop module. The experimental study was organized as part of the four-month course that included several theoretical lectures delivered by invited speakers and experts. The lectures covered disinformation and strategic information operations, news media management, responses to disinformation with fact-checking tools, and an overview of changing journalistic functions during crises.

Media education interventions were developed as a guiding framework to connect all of these diverse actions (lectures, discussion panels with experts, practical testing, and reflective sessions) into a logical sequence. Media literacy-aimed tasks were designed to improve journalism practices of attentive information source analysis and facticity verification. One of these was a lateral reading strategy, initially

developed by Stanford University professors and experts. The concept of lateral reading, and the overall pedagogical framework, emphasizes agentic features development of personal engagement and commitment, connecting self-awareness features with the intentionality to act (Bandura, 1991, 2006). A selected session with illustrative insights was designed to explain the logic behind this particular pedagogical intervention and media literacy approach for students.

In essence, lateral reading is based on a simple strategy for verifying information (Breakstone et al., 2021, 2024; McGrew & Breakstone, 2023; Wineburg et al., 2021), which resembles the work methods of professional fact-checkers. Such a "reading" strategy is often contrasted with vertical reading—a strategy people typically use when reading texts continuously. Vertical reading is somewhat representative of the continuous browsing of newsfeeds on social media. Conversely, lateral reading is promoted as a strategy that employs higher-level cognitive processes, emblematic of questioning and other strategies that align with the cultivation of internal dialogues, resembling what cognitive psychologists have defined as "hypertextual" reading (Balčytienė, 1999), linked with associative thinking and constructivist learning (Jonassen, 1991). It is a "slow" reading technique that requires the user to continuously question, which resembles an internal dialogue, and assess perceived information by noticing and identifying "textual claims" and facts and verifying them to build trust. Essentially, the strategy is built on a simple technique of web-based reading. When encountering new, unclear information, the reader should open a new search engine window to check the validity of the source. Following the inspection, the reader returns to the original information item and continues the reading and assessment procedure. Meanwhile, all the checked web sources remain open, and sometimes it may happen that attentive information users are working with dozens of websites open in parallel. In this case, one may suggest that the number of open websites reveals quantitative features of the analysis, such as showing the depth of analysis. While an intuitive strategy, the method is less applicable to social media apps.

As mentioned, lateral reading relies on information verification and directly builds on the working practices of fact-checkers. Two additional notes must be considered in clarifying this method's essence. First, the lateral reading strategy has a didactic idea that suits the application of the approach to various transmedial contexts, not just situations involving textual information processing. Specifically, lateral reading allows for going "beyond" what is directly visible (textual or visual information); it seeks activation of internal thinking and active questioning, which reveal higher-order skills and contribute to developing accountable and resilient professionalism. A second note is that the discussed experiment primarily looked for signs of self-efficacious learning and did not aim to test the ability to discern (dis)information; hence, major attention was directed to individual advancements on that side.

3.3. Data Collection and Thematic Reflexive Analysis

To register self-efficacious learning and gain deeper insights into the process while working with the proposed schemes of information verification, students were required to maintain reflective diaries with three specifically formulated questions, recording their responses to the method's applicability, strengths, and their personal feelings regarding internal struggles. These reflections were documented as post-training assignments, answered after the training course. Responses were compiled into a corpus of student answers and subjected to qualitative analysis.

To address the research question of identifying the development and awareness of specific characteristics of the tested media literacy intervention and emergent professional norms, it was decided to apply thematic reflexive analysis (Braun & Clarke, 2006; Nowell et al., 2017). This form of analysis was chosen to uncover specific aspects of the individual knowledge development rooted in diverse experiences when study participants were required to reflect on the media literacy method and its features, as well as their progress with emerging norms (Gagrčin et al., 2022), ease of learning, and transferability of acquired knowledge to others.

Overall, the thematic analysis required a focused and structured approach. As a first step, students' responses were retrieved from self-reflection diaries, which had a predefined structure with specific guiding questions requiring students to reveal their authentic experiences about the applicability of the chosen lateral reading method. The insights provided by students for each question were limited to one paragraph. This formed the basis of the data set.

The students' answers were further subjected to thematic analysis, subsequently identifying and organizing the identified "themes" that signaled "self-efficaciousness" within the data set. This approach appeared especially useful for summarizing the dominant features of self-efficacious responses identified in the data set, such as the students' critical reflections on their learning capacities, which showed features resembling regulatory aspects, intentionality to continue working, and possibilities for "knowledge transfer" (see Table 1).

The analysis created a detailed view of specific aspects of the applied intervention. Identified themes provided detailed insights into specific, question-driven data. It was also a highly engaging analysis process: While reading students' responses, new research focuses evolved from reflective thinking, interest, and growing insights about the analyzed issue. By deductively concentrating on students' self-conscious thinking, the researcher could identify the norms that guided students' actions.

4. Results: A Brief Examination of How Meaning Is Created When Using Media Literacy Interventions

The learning journey revealed significant enhancements in students' self-efficacy assessments, particularly in terms of their overall awareness, such as critical thinking skills, knowledge of fact-checking tools, and their understanding of the national information ecosystem. Epistemic features in the learning process were revealed in panel discussions with experts and practical settings when students were assigned practical fact-checking tasks.

The acquired self-efficacy capacities enabled journalism students to reflect not only on their existing information habits and cognitive biases but also on the most effective solutions and methods for journalism training, incorporating media literacy interventions to address reasoning patterns while dealing with disruptive content. When referring to the benefits of lateral reading, students talked about the activity as a media literacy strategy. As revealed (see Figure 1), a variety of norms signifying self-efficacious learning and contributing to professional character traits were identified and grouped into strategy clusters of Empowering (Mobilizing Capital, Individual Orientation & Responsibility, Knowledge Sharing & Transferability) and those requiring Perseverance (Critical and Caring Attitude).

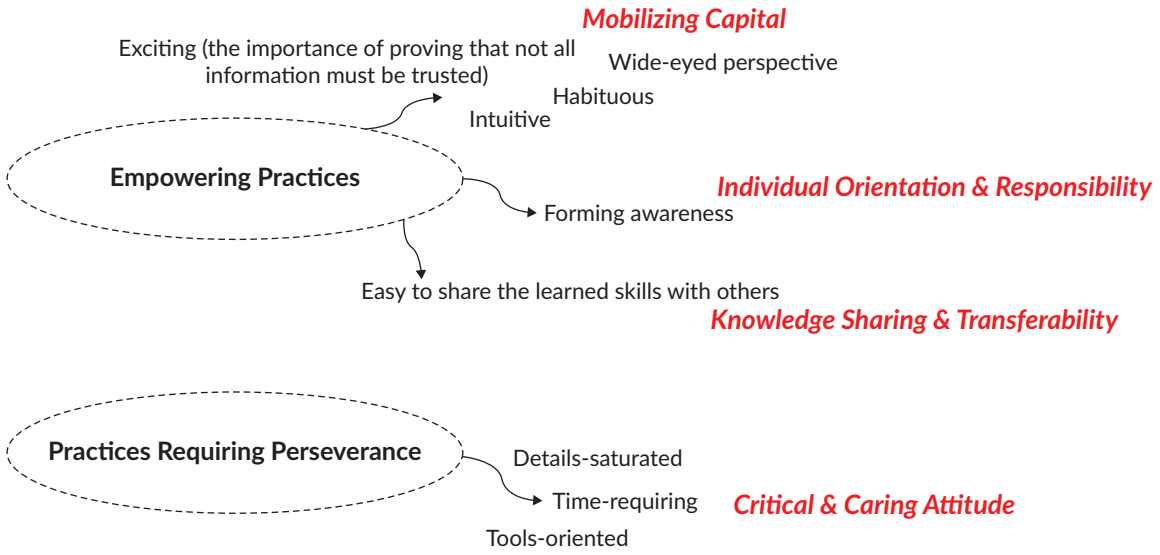

Figure 1. Self-efficacious learning norms that were derived from identified and coded assessments of progress.

Open classroom sessions with students revealed lateral reading to be a specifically engaging intervention. It is easy to understand and operate within real-life situations, as its functionality is built on intuitive responses. Furthermore, it also encourages the development of "self-control" through continuous self-reflection, which is particularly important for building awareness and resilience.

The students' responses exposed varying Empowering characteristics of the strategy. One group, defined as Mobilizing Capital, identifies features of lateral reading that students described as relying on intuitive, habitual (routine) forms of professionalism, which generate excitement and require having a wide-eyed perspective on the addressed issue. The other two groups—Individual Orientation & Responsibility and Knowledge Sharing & Transferability—rely on awareness building and skills transfer to new situations. Perseverance is a character trait that runs on the norm of having a Critical & Caring Attitude, which is essential for developing resilience. A brief example of how certain features were identified in journalism students' responses is presented in Table 1.

As provided examples show (see Table 1), in digitally mediated situations, such as accessing information on social networks, the agentive aspect of mental actions is dependent on changing media conditions and the association between acquired knowledge and motivation (feelings of excitement and other expressed reactions). Knowing what information verification is and seeking to define it, understanding the pedagogic reasoning behind the strategy and how it can be used to engage readers, and developing a personal view of the practice, appear to be especially beneficial in the learning process, as revealed by the study participants. Briefly, awareness of one's knowledge structuration assists in developing greater regulatory capacities and, thus, resilience. This applies to all users, not just journalism professionals.

Table 1. Student feedback on the lateral reading strategy.

Selected examples and quotes	Explanations of groups of norms	Strategy variations towards character development
Even before studying the subject, *I used to do something similar intuitively*—when I read a news item that seemed to contain inaccurate information, I would look for alternative sources, trying to trace the authors and the sources cited. In this course, I managed to define this concept, this process, as a natural, existing anti-disinformation tool. (Andrew) I learned more about the visibility of disinformation; [lateral reading] seemed quite understandable, but I had never thought before that *there are so many ways to find the truth*. For example, programs that help to establish the credibility of a video, side-reading, and identifying manipulation, even though the information presented may be accurate. (Regina)	Mobilizing Capital (guiding development of routine forms of professionalism, which generate excitement and require having a wide-eyed perspective on the addressed issue)	Empowering
The side-reading method [lateral reading] has become my primary fact-checking tool, which *I have to use in practice when I encounter possible misinformation* on the internet or in the media….I was a bit skeptical about the method when I first became familiar with it, but once I started to put it into practice, I realized its value. With a slightly more experienced perspective, I also had to take a fresh look at the concept of media literacy. (Andrew) Lateral reading is a new term, but I have used it even before without realizing it because it was always *interesting to check different information and see if it was really true*. (Regina)	Individual Orientation & Responsibility (forming awareness)	
I have noticed that it is generally quite challenging to reprogram older people (parents, relatives) with whom I have spoken on the subject, *but it is certainly worth the effort* to make society more educated and "media literate." (Andrew) *I will certainly continue to do so* [i.e., apply lateral reading] in the future because it helps to ensure greater reliability, and, for me at least, it is the curiosity to find more and more information that drives me to do more and more. (Regina)	Knowledge Sharing & Transferability (skills transfer to new situations)	
I think that *I will have to use this method* of checking "slanted" information in my everyday life, probably for the rest of my life without exception. (Andrew) On the positive side, you can find out quite quickly many different aspects of information that are distrustful. On the negative side, *it sounds complicated until you show someone else or try it yourself*. (Regina)	Critical & Caring Attitude (essential for the development of resilience)	Perseverance-focused

5. Conclusion and Discussion: Towards Responsible and Resilient Professionalism

Discussions about improving media literacy to build societal resilience often focus on the need to develop a broad range of capacities, including digital skills and cognitive abilities, to support individual empowerment and enable individuals to cognitively respond to potential information-related threats and harms (Hall & Lamont, 2013). Practicing such capacities requires individual agency and focused engagement with

information (Hendrickx, 2022; Hofmann, 2019; Marin & Copeland, 2022), which refers to the intrinsic motivation to become informed on various (political and social) issues.

As discussed in the theoretical section of this article, engagement with information processing, however, relies not only on cognitive knowledge but also on other factors. Decision-making in media-rich and information-saturated environments is much more complex than mere information retrieval and facticity verification. As is known, people's information use is driven by various motivations, including epistemic, social, and existential needs (Poier & Suchanek, 2024). Nevertheless, as revealed, regardless of people's engagement, media education instructions can be particularly beneficial for promoting self-conscious information processing, leading to the development of self-regulatory capacities. The latter is specifically needed to navigate complex media ecosystems responsibly.

Digitally infused structural developments of global platforms, along with algorithmic and AI-driven data organization and information structuration, create new social implications, many of which are yet to be identified (Hicks et al., 2024). Algorithms extensively manage access to news and relevant political information. Additionally, people lack the skills and awareness capacities to communicate with others in a manner that involves dialogic features, including questioning and attentive listening. All of these requests demand closer attention to agentive aspects, such as values and beliefs, intentions, and actions.

In such situations, instructional interventions should focus not only on the epistemic side of knowledge acquisition, as people may have false prior beliefs, but also on self-efficacious performance with the necessary self-regulatory capacities required to balance one's responses. New concepts, such as lateral reading, in training future journalists appear especially valuable in supporting self-awareness, which is highly needed for professional social responsibility development. These models provide practical interventions and offer avenues for future professionals to notice and voice their concerns while seeking ways to overcome pressures.

I began this article's discussion by suggesting that the media ecosystem's complexity demands that we collectively devise new strategies for informed media use. We need to find answers to adequately respond to the influx of manipulative content and the choices that must be made.

By drawing attention to self-efficacious learning features, my intention in this article is to issue a call to action to pay more vigorous attention to information users and their learning capacities. As noted by the classics of media literacy proponents, such as Potter (2004), and contemporary analysts of countering disinformation (Balčytienė & Horowitz, 2023; Harambam, 2021), we need a stronger, human-centered voice and a paradigmatic change in how we view responsible and resilient actions in digital information environments. Specifically, in addition to explaining how media environments work, what disinformation is, and guiding media users to channels of trustworthy news, we must provide them with adequate capacities to comprehend their learning features and, ultimately, help themselves.

As proposed here, media professionals must also become active partners in such a process, and conventional professional journalistic routines, such as information verification, may be turned into inspiring strategies for ordinary citizens to adapt to their everyday information use situations. It is evident that for such a process to take place, several conditions must be satisfied. Thus, more efforts must be dedicated to finding pedagogic

approaches to lead media users (and journalists) to learn about their values and moral standing and how these factors determine decision-making.

First, it is essential to recognize that selecting and communicating information, along with the subsequent process of meaning-making, involve complex aspects of information processing. A complex interplay of technological features of digital media and information-related aspects influences digital content processing. Simply put, individual activities involved in knowledge construction, such as decision-making and assigning meaning, transcend individual cognitive functions. Meaning-making and internalization of knowledge require closer research to focus on individual socio-psychological processes and community interpersonal relations, all of which play a role in information processing and (professional) identity construction (Harambam, 2021).

Second, in digital environments, it becomes paramount to have a critical perspective on how one's information choices and learning are influenced by media context and to be aware of how individual actions can impact the responses of others. In this regard, in searching for new models of dialogic, attentive, and caring journalism (see, for example, calls expressed by Kavada, 2024; Papacharissi, 2014; Wasserman, 2015), a human-centered approach seems vitally significant in journalism education to explain individual information processing features.

Third, focused scholarly analysis is required to provide educational instructions for developing professional awareness. This involves a focus on agentive features, such as moral awareness, which underlies the meaning-making processes. Therefore, teaching modern professionalism requires focus on the journalists' decision-making actions of accessing and producing online information, recognizing that such a process includes not only the analysis and production of content—such as knowledge and facts—but also the sharing of attitudes and (moral, ethical) formations embedded within these acts and experiences. Hence, for contemporary journalism, it becomes critically important to learn how epistemic tradition and social culture become locally embedded and institutionalized, what qualitative communication principles (for example, transparency and accountability) these acquire, and how these are adopted by professionals and accepted, maintained, and shared by other groups of people.

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Conflict of Interests

The author declares no conflict of interests.

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Effects of a News Literacy Video on News Literacy Perceptions and Misinformation Evaluation

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Abstract

The mixing of misinformation with high-quality news and information on social media has reinvigorated interest in the value of news literacy (NL) to build audience resiliency to misinformation. Optimizing NL messages for social media environments—where they may be seen alongside misinformation—allows these messages to reach audiences when they are most likely to benefit from them. Using a 2 (NL video vs. control video) × 2 (sunscreen promotion video vs. sunscreen misinformation video) online survey experiment ($N = 780$), we examine whether exposure to an NL video improves perceived personal NL skills and value for news literacy, as well as enables participants to recognize and avoid engaging with misinformation. Our findings suggest that after watching the NL video, individuals valued NL more but their self-perceived news literacy did not improve. Furthermore, watching the NL video made individuals rate the second video as less credible and reduced engagement with it no matter whether the second video contained misinformation or quality information. This research has several important implications. While watching an NL video could protect individuals by discrediting and decreasing engagement with misinformation, it may do so at the expense of high-quality information. We discuss the difficulty in designing NL messages that lead people to be appropriately skeptical and able to discern between high- and low-quality health information, rather than cynically disengaging with media content altogether.

Keywords

health information; media literacy; misinformation; news literacy; skepticism

1. Introduction

Media literacy has been posited as one way to protect people from the risks (Joris & Livingstone, 2020) of mis- and disinformation (Vissenberg et al., 2023), which can result in concrete harms to both individuals and the public (S. K. Lee et al., 2022), although others contest such harms are often overstated (Budak et al., 2024). Specifically, prior research suggests that exposure to misinformation could increase misperceptions (Vraga, Bode, & Tully, 2022), and reduce vaccination intentions (Thaker & Subramanian, 2021). Existing research on media literacy education in classrooms (Wineburg et al., 2022) and interventions designed for the web and social media, including short videos, posts, and comments, suggest that both formal and informal media literacy efforts can affect perceptions of information quality and discernment (Guess et al., 2020; Hameleers, 2022; Tully et al., 2020; Vraga & Tully, 2015). Creating news literacy (NL) messages optimized for online sharing offers important advantages over in-classroom approaches: These messages can be implemented at a larger scale and for a more diverse population than classroom campaigns, which are often limited to K–12 education. They also may intervene near the point of exposure to online misinformation, boosting their potential impact.

In this study, we explore whether exposure to a short video communicating key NL tenets shared on social media can lead people to not only feel more confident in their NL skills but also apply those skills to distinguishing between misinformation and high-quality information—like verified news or scientific communication (Singh et al., 2020)—online. Although a short video, designed to mimic an online public service announcement (PSA), cannot provide in-depth media literacy education, it can offer key concepts and tips for how to approach news and information, including how to avoid or recognize mis- and disinformation (Vraga & Tully, 2015). For some viewers, these videos serve as reminders of media literacy concepts and skills that they already know. For others, they provide manageable tips and key pieces of information that could serve as a starting point for further education. If these short messages can shape perceptions and responses to information, they provide an additional mechanism to address misinformation as part of regular media consumption (Hameleers, 2022). Intervening on social media platforms with short media literacy messages, videos, and graphics could serve as both reminders and prompts for responding to misinformation in a way that leverages the potential of the platforms as conveyors of both real and false information.

1.1. Misinformation on Social Media

Although misinformation is an evergreen problem (Uscinski et al., 2022), concerns about misinformation have grown in part because social media has made it easier to share information—true or false—quickly (Wang et al., 2019). Indeed some research shows that misinformation may even spread more quickly than true information online (Vosoughi et al., 2018). Misinformation on social media is concerning given that belief in misinformation is often associated with harmful behaviors (Pierri et al., 2022; Porter & Wood, 2022). Given these concerns, researchers and educators have proposed several mechanisms to address the spread and belief in misinformation, including education-based approaches like media literacy interventions. While media literacy interventions might be most appropriate for identifying disinformation, defined as false information that is intentionally created and disseminated (Guess & Lyons, 2020), we think they should also apply to any situation requiring assessing the veracity of information—including misinformation and low-quality information (Singh et al., 2020). For this reason, we use the broader and more inclusive *misinformation* throughout the manuscript, while recognizing that there could be differential impacts for different types of false information.

1.2. NL to Counteract the Influence of Misinformation

1.2.1. NL as a Form of Media Literacy

NL is often considered a type or subfield of media literacy and is related to other literacies, including information and digital literacy (Jones-Jang et al., 2021; Potter & Thai, 2019). Jones-Jang et al. (2021) tested whether individuals with greater media, news, information, and digital literacy were better at recognizing misinformation (which they call fake news). They found that those with higher information literacy were better at recognizing false news, but the other literacies did not produce the same results. Others, however, have found that higher NL is related to identification of misinformation and rejection of conspiracy beliefs (Craft et al., 2017). Cho et al. (2024) propose a conceptual framework for "social media literacy" that builds on the same basic premises—considering content and competencies—for navigating social media environments.

In this study we focus on NL, using the definition proposed by Vraga et al. (2021, p. 15) as "knowledge of the personal and social processes by which news is produced, distributed, and consumed, and skills that allow users some control over these processes." This definition emphasizes knowledge, skills, and individual control, building on earlier theoretical work on media literacy from Potter (2004) and definitional work from Maksl et al. (2015). We focus on NL given its theoretical and practical relationship with misinformation (Vraga et al., 2021).

NL also emphasizes the role of news and misinformation in civic life on both the individual and societal levels (Geers et al., 2020; Tully & Vraga, 2018) as people make decisions, in part, based on the true and false news they consume. The emphasis on the knowledge and skills to distinguish between high- and low-quality information is particularly relevant to the study of misinformation, which is often designed to look like news or share similar (albeit inaccurate) characteristics (Damstra et al., 2021). Therefore, NL is a particularly relevant form of literacy to address misinformation perceptions and behaviors.

1.2.2. The Effects of an NL Video on News Literacy Perceptions

Designed to look like a PSA, the NL video in this study describes the online information environment as one in which credible news and false information are often mixed up. NL has been increasingly integrated into PSAs and promotional campaigns (van der Meer & Hameleers, 2021; Vraga & Tully, 2016a, 2016b). Just as PSAs, ads, and broader promotional campaigns have been used to influence individuals' beliefs and attitudes toward health behaviors (Kowitt et al., 2023), NL PSAs aim to enhance the public's ability to navigate complex information environments, where credible news and misinformation often coexist.

Our NL video contained three elements designed to increase its ability to shift people's attitudes and help them recognize misinformation. First, the NL video gave a warning that people may be exposed to misinformation. Based on the inoculation literature, this forewarning of possible misinformation exposure should raise people's awareness and defenses to misinformation (Banas & Rains, 2010; Compton et al., 2021). Second, the NL video provided concrete suggestions for how to recognize misinformation, specifically in terms of paying attention to the source and intent of messages and questioning whether claims are true. Previous works using these types of NL tips have shown that they can help people distinguish between misinformation versus vetted news sources (Guess et al., 2020; Hameleers, 2022). Finally, the NL message

contained a "call to action"—encouraging people to think about the accuracy of messages and to be critical news consumers. These accuracy nudges can help people recognize misinformation and improve the quality of the information they share (Pennycook et al., 2020; Pennycook & Rand, 2022). Because we designed this video to be part of a social media campaign, we focus on online misinformation in particular.

We first consider the effects of the NL video on two attitudes, SPNL and VNL, both of which have been adapted from earlier work on self-perceived media literacy and value for media literacy (Vraga, Tully, & Bode, 2022). These two measures capture NL perceptions related to the individual level (SPNL) and societal level (VNL).

Individual agency and self-efficacy are important to developing SPNL (Vraga & Tully, 2021; Vraga et al., 2021). SPNL measures individuals' assessment of their NL, rather than an objective measure of their actual NL, an important distinction because these two measures are theoretically and empirically distinct (Vraga et al., 2021). Building on the theory of planned behavior, Vraga et al. (2021) propose that perceived behavioral control—"whether individuals believe the behavior in question is within their control"—is an important factor in predicting NL behaviors (p. 15). SPNL captures this perception by asking for self-evaluations of NL. In addition to providing information that should contribute to building actual NL (e.g., highlighting that misinformation often lacks evidence to support its claims), the NL video emphasizes individual agency and action to promote critical evaluation and engagement to build SPNL. This is important because SPNL is positively correlated with intentions to refute rumors (Borah & Lorenzano, 2023) and could potentially drive people to apply their NL in real life (Su et al., 2022), although Vraga and Tully (2021) found that higher self-perceived media literacy contributed to less skepticism toward information on social media. Similarly, research has found that increased media and news literacy can lead to skepticism toward all information, including accurate information, suggesting the potential for unintended effects (Blair et al., 2024; Hoes et al., 2024). Therefore, it is important to assess the effectiveness of the NL video to promote both increased self-efficacy (H1) and actual ability to assess credibility (H2) as a means of understanding the relationship between the intervention, efficacy, and information perceptions. We expect exposure to the NL video to increase SPNL because it focuses on individual action and control in finding and evaluating the quality of information, directly tapping into SPNL constructs.

In addition, the NL video puts news and misinformation in context and describes the importance and function of news in society, which should encourage people to recognize the importance of NL to society, measured as VNL. VNL captures the perception that NL is important to an informed society moving beyond the individual level to connect to society at large. Vraga et al. (2015) found that higher value for media literacy was associated with news skepticism and Vraga and Tully (2021) found that respondents with higher value for media literacy were less likely to post on social media, suggesting that value for media literacy is linked to NL behaviors (Vraga et al., 2021). By connecting NL to an informed society, VNL attempts to capture social norms surrounding NL, another component of the model for news literacy behaviors (Vraga et al., 2021).

Given the focus of the NL video on individual action and its connection to critical news consumption, we propose the following hypothesis:

> H1: Exposure to the NL video will produce higher levels of (a) SPNL and (b) perceived VNL, compared to exposure to a control video.

The context in which the NL video appears may also influence SPNL and VNL. Vraga and Tully (2015) found that the context in which a media literacy PSA video was shown affected perceptions of the PSA and of adjacent content. For example, viewing the NL video in combination with an accurate video may make NL seem less important as the adjacent content may not raise concerns about misinformation (the focus of the NL video). Viewing the video in combination with a misinformation video could remind viewers of the key messages in the NL video and bolster SPNL and VNL, or it could make viewers feel less sure of their abilities or the value of NL. Given these possibilities, we ask:

> RQ1: Will the effects of the NL video on (a) SPNL and (b) perceived VNL differ depending on the content of the second video (sunscreen promotion video vs. sunscreen misinformation video)?

1.2.3. The Effects of an NL Video on the Evaluation of Videos

While the NL video should ideally lead people to recognize the value of NL and feel more confident in their own NL skills, fundamentally NL is about giving people the ability to more carefully navigate their media environment by applying their knowledge and skills to media consumption. As such, the best test of the success of an NL intervention is whether it helps people distinguish between high- and low-quality information, an example of an NL behavior (Vraga et al., 2020).

Theoretically, there is strong evidence to believe the NL video should do exactly that. While some studies have found that NL messages were not effective in helping people recognize misinformation (Vraga, Tully, & Bode, 2022) nor reduce the persuasive power of misinformation (Hameleers, 2022; Vraga, Bode, & Tully, 2022), we designed our NL video to incorporate three best practices: a warning, concrete suggestions to recognize misinformation, and a call to action to serve as a nudge towards accuracy. Therefore, we believe that the combination of these three elements will make viewers of the NL video more likely to recognize a misinformation video as less credible than a promotional message about sunscreen use, a task that should be more difficult without such exposure:

> H2: Exposure to an NL video will produce higher assessments of the credibility of the sunscreen promotion video and lower assessments of the credibility of the sunscreen misinformation video, compared to exposure to a control video.

1.2.4. The Effects of an NL Video on Engagement With Videos

Beyond effects on NL and credibility, we further expect the NL video to affect whether people engage with the video—by which we mean like, share, comment on, or follow the creator of the video. Most research on misinformation and engagement has focused directly on the question of sharing misinformation (rather than the other outcomes we consider as part of engagement, including liking, commenting, and following). Within that literature, a growing consensus suggests that people share misinformation, not necessarily because they believe it is true, or even because they think it supports their identity, but simply because they are not thinking about accuracy (Pennycook et al., 2021; Pennycook & Rand, 2019). Interventions that have prompted people to think about the veracity of information have seen resulting decreases in intention to share misinformation (Pennycook et al., 2020; Pennycook & Rand, 2022).

Along those same lines, we would expect that the NL video, by drawing attention to the problem of misinformation and a general awareness of veracity as a concept, would similarly remind people to consider accuracy before deciding whether or not to engage with content. However, because our measurement is different from most research on this topic, we offer a research question rather than a directional hypothesis:

> RQ2: Will the effects of the NL video on engagement—like, share, comment, and follow—with the sunscreen video differ depending on the content of the second video (sunscreen promotion video vs. sunscreen misinformation video)?

2. Methods

2.1. Materials and Procedure

We used a 2 (NL video vs. control video) x 2 (sunscreen promotion video vs. sunscreen misinformation video) online survey experiment (N = 780) to test our expectations (n = 176 for the NL video + sunscreen promotion video condition; n = 194 for the NL video + sunscreen misinformation video condition; n = 219 for the control video + sunscreen promotion video condition; n = 191 for the control video + sunscreen misinformation video condition). After answering a pretest questionnaire including their demographic information and their preexisting attitudes toward sunscreen, participants were randomly assigned to one of four conditions and watched two separate videos. Video 1 lasted roughly 30 seconds, with participants randomly assigned to see either an NL video (emphasizing the importance of assessing information quality, see https://www.youtube.com/watch?v=O-8DV9QiZXI) or a control video (about the dangers of texting and driving, see https://www.youtube.com/watch?v=G7SlVJ4xtyw). Participants then evaluated the quality of Video 1 and their engagement with Video 1 before being randomly assigned to watch one of two sunscreen videos. Both videos were roughly 50 seconds long and covered either the benefits of different types of sunscreen (promotion video, see https://www.youtube.com/watch?v=djieZNLiCas) or contained inaccurate information about the health risks of sunscreen (misinformation video, see the Supplementary File for transcript). Finally, participants completed the post-test questionnaire, containing our four key outcome measures: sunscreen video credibility, engagement with the sunscreen video, VNL, and SPNL. Participants were compensated for their participation at the end of the questionnaire, via the Lucid platform.

We hired 2,173 participants using Lucid in August 2019, and after data cleaning (eliminating those who did not complete the survey experiment, or did not pass data quality measures, including finishing the survey in less than 5 minutes, offering identical responses across many questions, failing the attention check, or reporting not seeing or hearing both videos) 1,348 participants were eligible for the data analysis. Seven conditions were included in the original design, but this study dropped those in the two sunscreen correction conditions (n = 382) and the pure control condition (n = 186) to focus on how the NL video affects individuals' processing of misinformation (as compared to high-quality information), with a total of N = 780. In this study, 52.8% of the participants were female, 76% were White (with 11% African-American, 4.5% Asian, 0.8% Native-American or Inuit, and 7.7% other races), 15.3% of Hispanic, Latino, or Spanish origin, median education was some college (no degree), median income was $50,000–75,000 per year, and median age was 45–54 years old.

2.2. Measures

VNL is measured by asking the participants to rate their agreement on two statements on a 7-point Likert scale (*strongly disagree* to *strongly agree*). These two statements are "News literacy is important for society" and "People need to carefully evaluate news content to make informed decisions," adapted from Vraga, Tully, and Bode (2022), $r = .48$, $p < .001$, $M = 5.76$, $SD = 1.02$.

SPNL is measured by asking the participants to rate their agreement on two statements on a 7-point Likert scale (*strongly disagree* to *strongly agree*). These two statements are "I am confident in my ability to distinguish high and low-quality content" and "I have the skills to interpret news content," adapted from Vraga, Tully, and Bode (2022), $r = .59$, $p < .001$, $M = 5.26$, $SD = 1.12$. Results from a Pearson correlation analysis suggest that VNL and SPNL are significantly correlated ($r = .530$, $p < .001$).

Sunscreen video credibility is measured by asking the participants to rate their perceptions of the sunscreen video using seven pairs of adjectives, ranging from "inaccurate/accurate" to "not trustworthy/trustworthy" on a 7-point bipolar scale, adapted from Roberts (2010), $\alpha = .94$, $M = 4.51$, $SD = 1.76$.

Engagement with sunscreen video is measured by asking the participants to rate their likelihood to "Like the video," "Share the video," "Comment on the video," and "Follow the creator of the video" on a 5-point Likert scale (*extremely unlikely* to *extremely likely*), $\alpha = .92$, $M = 2.42$, $SD = 1.22$.

3. Results

To test H1 and H2, and to answer RQ1 and RQ2, a MANOVA was used to estimate each dependent variable. One single MANOVA was used, with all independent variables (including the interaction term) and all outcome variables put as the dependent variables into the MANOVA model.

H1 hypothesized that exposure to the NL video would produce higher SPNL (H1a) and VNL (H1b) as compared to the control condition. H1 was partially supported. H1a was rejected as SPNL didn't differ significantly between the two conditions (see Table 1). H1b was supported, as participants rated the VNL significantly higher in the NL condition compared to the control condition (see Table 1).

RQ1 asked whether the effects of the NL on (a) SPNL and (b) VNL differ depending on the content of the second video (i.e., sunscreen promotion video vs. sunscreen misinformation video). Results suggest that the content of the sunscreen video did not interact with the NL video to explain SPNL ($F = 2.09$, $p = .15$) or VNL ($F = .01$, $p = .95$).

Similarly, H2 hypothesized that exposure to the NL video would boost the credibility of the sunscreen promotion video and reduce the credibility of the sunscreen misinformation video, compared to not seeing the NL video. RQ2 asked whether the effects of the NL video on engagement with the sunscreen video differ depending on the content of the second video (promotion vs. misinformation). H2 was rejected. Results suggest that the content of the sunscreen video did not interact with exposure to the NL video to predict sunscreen video credibility ($F = .00$, $p = .99$) nor engagement with the sunscreen video (RQ2, $F = .36$, $p = .55$). However, there was a main effect of exposure to the NL video on both sunscreen video credibility

and engagement with the sunscreen video (see Table 1). Specifically, people who saw the NL video rated the sunscreen video as less credible and reported *lower* intentions to engage with the video regardless of the content of that video—specifically, whether that video contained accurate information promoting the use of sunscreen or contained misinformation about sunscreen's effects on the body.

Table 1. Comparing the NL video condition against the control video condition on dependent variables.

Dependent variable	F-test	η_p^2	NL video (mean)	NL video (*SD*)	Control video (mean)	Control video (*SD*)
VNL	4.71*	.006	5.84^{+}_{a}	1.07	5.69_{b}	.98
SPNL	.02	.000	5.26_{a}	1.15	5.27_{a}	1.10
Sunscreen video credibility	10.21**	.013	4.27^{+}_{a}	1.74	4.72_{b}	1.76
Engagement with sunscreen video	5.68*	.007	2.30^{+}_{a}	1.18	2.52_{b}	1.25

Notes: Different subscripts ($_{a,b}$) indicate significant differences between conditions for that dependent variable, $p < .05$; $^{+}$ significant effects; *** $p < .001$; ** $p < .01$; * $p < .05$; also, please note that the first three dependent variables, including VNL, SPNL, and sunscreen video credibility were measured on a 7-point Likert scale, and engagement with sunscreen video was measured on a 5-point Likert scale; though 780 participants in total completed the study, only 776 participants were included in the MANOVA analysis given missing responses to the dependent variables.

4. Discussion

This research aimed to understand how exposure to a short NL video created for social media could influence participants' NL perceptions, as well as their subsequent evaluation of an online video and engagement with it depending on whether it shared misinformation. Our findings reveal that exposure to the NL video produced significantly higher perceived VNL compared to a control condition. This suggests that even short, targeted interventions can improve the awareness of how valuable being news literate is: Participants who watched the NL video recognized the societal importance of NL and the need for careful evaluation of news content to make informed decisions. However, the NL video was *not* successful in producing higher estimates of SPNL as compared to the control. This adds to research reporting mixed effects of textual and image-based NL messages (tweets) in boosting these perceptions of one's own NL skills (Tully et al., 2020; Vraga, Tully, & Bode, 2022). These findings reinforce the potential disconnect between recognizing the importance of NL and feeling personally efficacious in navigating news content (Geers et al., 2020), which may be the precursor of applying NL in real life (Su et al., 2022) and is positively correlated with intentions to refute rumors (Borah & Lorenzano, 2023). This also highlights the challenge of translating awareness and appreciation of NL into value for and self-confidence in one's abilities. Thus, improving SPNL may require more intensive or repeated interventions across a number of modalities, a research area that needs further investigation.

In addition, this study demonstrates that the NL video influenced how participants evaluated subsequent videos, regardless of their content. Specifically, participants who watched the NL video rated the sunscreen videos—whether promoting accurate information or containing misinformation—as less credible and reported lower intentions of engaging with those videos. This outcome highlights a potential unintended consequence of NL interventions: a generalized cynicism and reticence towards both misinformation *and* accurate information (Ashley et al., 2023; Guess et al., 2020; Hameleers, 2022). While skepticism can be protective against misinformation, a blanket distrust of information, including high-quality content, is

harmful for democracy (Hoes et al., 2024; Vraga & Tully, 2021). Likewise, wariness towards engaging with media content can indicate a cautious approach to media consumption post-exposure to the NL video, but it also raises concerns about reduced engagement with valuable content, which is crucial for informed citizenship and effective public health communication. Another more hopeful possibility is that these results indicate participants are maintaining skepticism and withholding engagement until they can investigate the credibility of the sunscreen video, something they are unable to do in this context. Future research should explore whether people engage in more proactive verification behaviors after seeing an NL message, especially when confronted with new or unfamiliar information.

Our study has several important implications for the design and implementation of NL interventions. Our NL video was designed with best practices in mind. Based on inoculation theory, we warned people about likely misinformation exposure and taught them how to recognize it (Banas & Rains, 2010; Compton et al., 2021). Then, we incorporated a call-to-action, encouraging people to think about accuracy and be critical consumers to hopefully boost efficacy. Despite these efforts, the NL video still appeared to create cynicism rather than skepticism towards subsequent health messages. While increasing skepticism towards misinformation is a key goal of NL, balancing this with promoting engagement with high-quality information is essential. Future interventions might need to more clearly distinguish between skepticism towards dubious sources and trust in credible ones to avoid fostering a generalized distrust of media. It is crucial to design these messages in ways that encourage critical thinking without leading to disengagement from all media content. This may involve developing interventions that aim not only to alert users to the presence of misinformation but also to reinforce the characteristics of trustworthy information. This dual approach could help mitigate the unintended consequence of generalized cynicism.

Additionally, this study suggests that interventions should not only highlight the importance of NL but also include elements that build self-efficacy to improve SPNL. Practical tips, repeated exposure, and efficacy messages, including elements of both self-efficacy (i.e., "I can do this") and response efficacy (i.e., "NL works"), might help boost participants' confidence in their NL skills and their application when exposed to misinformation.

This research is not without limitations. One limitation of this study is the short duration of exposure to a single NL video. The long-term effects of repeated exposure to diverse NL content and modalities remain unclear. Future research should explore the impact of sustained and varied interventions on both actual NL (measured as knowledge and skills) and SPNL, as these two distinct concepts theoretically predict NL behaviors (Vraga et al., 2021). Also, the use of a five-point response scale for the engagement items is a limitation of our study, as it means there is less variance in these responses compared to the other outcome variables. Second, the sample is not fully representative of the general population. Future research should aim to replicate these findings with more diverse samples to enhance generalizability, as well as identify and target groups who may be most in need of NL messages. For example, prior research suggests that those with lower education levels, and people from racial minority communities may be more susceptible to misinformation (Nan et al., 2022) and therefore most in need of NL messages. Future research can design NL messages intended for these groups, which might be helpful to increase discernment, i.e., the ability to distinguish misinformation from accurate information, instead of general skepticism toward online information (A. Y. Lee et al., 2024). Additionally, future research should examine the effects of NL interventions in different contexts and among diverse populations, which can provide more nuanced insights into their effectiveness and potential unintended consequences.

5. Conclusion

Ultimately, this study highlights the potential of short NL videos to increase the perceived value of NL and influence media evaluation and engagement behaviors. It also demonstrates the complexity of designing effective interventions that foster appropriate skepticism without leading to cynicism and disengagement from quality information. As misinformation continues to pose challenges in the digital age, refining NL efforts to address these nuances is essential for building a well-informed and resilient public.

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Conflict of Interests

The authors declare no conflict of interests.

Data Availability

The authors are willing to share their data, analytics methods, and study materials with other researchers upon reasonable request.

Supplementary Material

Supplementary material for this article is available online in the format provided by the authors (unedited).

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Reflecting With Teachers on Research-Based Tools: The ySKILLS Education Toolkit

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Abstract

This article focuses on the links between academic research and educational practices, examining how practitioners use, contextualize, and co-construct research findings on digital skills. To explore these issues, firstly we present an education toolkit developed within a European research project and aligned with normative and substantive guidelines for science communication. Aiming to grasp the potentialities and limitations of the toolkit in action, we then explore the perceptions of teachers from two educational settings in Portugal who employed it in their classrooms. Subsequent focus groups evidenced overall positive feedback from teachers, complemented by practical tips to improve the usefulness of the toolkit and adherence to it by teachers and students, thus adding layers of knowledge to the performative dimension of an evidence-based resource and building bridges between the academic and professional worlds.

Keywords

education toolkit; educational tools; digital skills; research-based education; science communication

1. Introduction

Digital skills, broadly understood as the ability to apply knowledge in the digital context to achieve personal and social benefits and mitigate risks associated with its negative aspects (Helsper et al., 2020), are presented as an unavoidable issue in contemporary education. Alongside an understanding of how to use digital devices, research emphasizes the importance of fostering digital literacy—the conceptualization of which goes beyond functional aspects to include critical ones—and the ability "to shape as well as use digital platforms and environments, building on knowledge about why ICTs do what they do and what the consequences of this for individuals and society might be" (Smahel et al., 2023, p. 12).

Continuous change in digital technologies and concerns over their impacts have resulted in a variety of terms and approaches to digital literacies, such as "data and privacy literacy" (Livingstone et al., 2020) and "critical big data literacy" (Sander, 2020), which require the attention of educational systems, schools, and teachers (Ilomäki et al., 2023). These literacies are intertwined with children's rights and citizenship, promoting an approach based on the premise of agency (Pangrazio & Sefton-Green, 2021).

Yet, school curricula and teachers' practices struggle to keep up to date in a constantly evolving field undergoing rapid transformation, thus compromising the adequate education of students. Some critics point to the narrow emphasis on technical and informational skills (Falloon, 2020), which are normally restricted to a separate school subject (Pettersson, 2018). Others identify the challenges teachers face in understanding and getting involved with students' digital lives (Saul, 2016).

Research on pedagogical strategies to promote digital literacies generally agrees on building on active learning paradigms, promoting critical consciousness, and learning by doing or discussing (Jones & Mitchell, 2016; Willeck & Mendelberg, 2022). At the same time, the existing literature has been highlighting the role of researchers in contributing to educational thought on this matter, whether by devising general frameworks or vocabulary (Saul, 2016) or by suggesting new approaches (Pettersson, 2018).

In this regard, what are the links between research and educational practices? How are research findings on digital literacy/skills used, contextualized, and co-constructed by practitioners? Considering the cultural role of research (Biesta, 2007), we aim to understand teachers' perspectives on a research-based tool. Our research questions, which focus on how teachers receive and appropriate this practical tool, are the following:

RQ1: What are the potentialities and limitations of the education toolkit in action?

RQ2: How could the education toolkit be improved?

RQ3: How do teachers see the relationship between research and their pedagogical practice?

Section 2 explores the connections between research and education within the framework of the evidence-based education movement, alongside general criteria for evaluating the quality and effectiveness of science communication. We then move on to presenting the ySKILLS Education Toolkit and analysing teachers' perceptions, after detailing the methodology for data collection.

2. The Context: Linking Research and Education

2.1. From Research to Educational Practices: A Critical Approach

Although not new, the evidence-based education movement has been gaining momentum to the point of being called a hegemonic force (Wescott, 2022). The myriad of expressions used to refer to this movement in teachers' practices—e.g., research-based profession (Hargreaves, 2007) and knowledge mobilization (Levin, 2011)—are based on the assumption of rationality in educational practice, which would use scientifically produced knowledge to make decisions and improve results, and on a linear and unidirectional model, where scientific knowledge would have an operational and instrumental relevance for practice (Lindblad & Pettersson, 2023).

This focus ultimately regulates research, as not all evidence is regarded as scientific proof. Methods based on controlled trials with random samples, robust statistical models, and causal analyses are given priority (Biesta, 2007; Welsh, 2021). It also constrains teachers' practice, minimizing their agency in a context where trust and legitimacy for these professionals are already on trial.

However, there are multiple ways for professionals in the field to participate in the (co-)production and use of knowledge, besides the instrumental one. Welsh (2021) identifies conceptual use (research that shapes a view of problems and solutions), symbolic use (research that validates previous positions, preferences, or decisions), and process use (incorporating research into the work of practitioners). Rather than a linear moment, research use in practice is thus a "labyrinth process" (Welsh, 2021, p. 173).

Consequently, there are also different ways for research to inform practice. Biesta's (2007) distinction between the technical and cultural role of research helps us highlight the need to improve the relationship between research and education, adding a reflective dimension to the discussion about "what works," contributing to critical questioning, understanding problems, or building alternative paths of action. Therefore, creating robustly sound and practical research is only part of the challenge: It is crucial, even an ethical issue (Taylor, 2019), to consider how to effectively translate and disseminate results to educators so they can incorporate research findings into their thinking and practices (Owen et al., 2021).

Regarding the relationship between research and practice in digital skills education, the most well-known initiatives derive from joint efforts to put this theme on the agenda—following its identification as a key competence for lifelong learning by the European Parliament and Council in 2006—and to clarify its meaning. Existing frameworks have expanded their definitions, areas, and levels of proficiency, like in the most recent version of the Digital Competence Framework for Citizens (Vuorikari et al., 2022). There are also specific frameworks for teachers, designed to integrate technology into their practice—e.g., the Technological Pedagogical Content Knowledge (Mishra & Koehler, 2006)—or for self-assessing and reflection on competences and needs—e.g., the Digital Competence of Educators (Redecker & Punie, 2017) and the UNESCO ICT competence framework (Butcher, 2018). These are mostly used in education for self-assessment purposes, to legitimate training proposals, and for curriculum evaluation (Santos et al., 2021), and some authors call for a shared institutional responsibility for their implementation (Falloon, 2020). Policy documents and research papers on school education focusing on critical digital literacies tend to emphasize e-safety and online risk issues, while giving less attention to benefits and opportunities (Ilomäki et al., 2023).

Other international initiatives develop research-based practical guidance and educational resources for teachers. This is the case of the Better Internet for Kids portal and the Common Sense platform, which add to the existing frameworks the availability of training and pedagogical resources. On another level, there has been an investment in intervention programmes to foster digital skills. According to a recent literature review, those programmes are mostly directed at (future) teachers and students (especially university students) and favour formal courses or workshops to the detriment of bottom-up or beneficiary-led initiatives (Martinez et al., 2023). Thus, collaborative research projects and co-construction of materials between academics and practitioners seem to be lacking.

2.2. Creating Educational Tools From Research Results

Transforming research results into educational tools is a challenge that requires thinking about how to communicate/translate scientific results in a manner that is understandable (Bertemes et al., 2024), i.e., how to deal with science communication. The criteria put forward by Lafrenière and Cox (2013) for evaluating the quality and effectiveness of science communication include normative, performative, and substantive aspects. Normative aspects pertain to the quality of the research, for example, in terms of methodological rigour and ethical appropriateness, and to the aim of ensuring that the interpretations made in scientific communication are based on valid conclusions; they deal with determining what content should be included. Performative aspects relate to the communication work and its effect on audiences (e.g., whether the language used is accessible, promotes engagement, and helps the audience understand and appraise the issues, and what feelings it generates). Substantive aspects refer to the textual and visual characteristics of the science communication format. Both substantive and performative aspects relate to how to present content.

As regards the substantive aspects, scientists must use clear and concise language and adapt it to the target groups. They must simplify their communication, but not to the point that it is no longer scientifically correct. To achieve this, Bertemes et al. (2024) suggest four key points: (a) avoiding scientific jargon or explaining it in simpler terms when first using it; (b) being aware that the same word can mean different things to different audiences; (c) considering that different cultures and experiences may influence how people interpret what is said; (d) being aware that the language style is important, therefore using short sentences, simple words, and the active voice.

Since communicating complex information to non-experts requires simplification, contextualization, and framing to achieve specific outcomes, engaging non-academics (e.g., teachers and children) is crucial to reducing message bias (Cormick, 2019). In addition, listening to children is an expression of the mutual learning principle, according to which adults can learn from young people's perspectives and experiences and vice versa (Bødker et al., 2021). It is also in alignment with the children's right to participate and be involved in matters that are important to them and affect their lives (Lansdown, 2005).

Additionally, visual information is important in science communication as it can attract attention, generate excitement, educate, and sometimes even manipulate, all at once. Furthermore, visual information is processed more rapidly and often conveys a more complex pattern than textual information (Bertemes et al., 2024). Therefore, educational tools must have a visual identity that is engaging and attractive for the intended audience. Using interactive formats to share information can ensure that the audience understands and actively engages with and interprets the findings.

These guidelines will help us present the methodology used to design an educational tool developed specifically to communicate scientific resources and results within the framework of the ySKILLS project.

3. The ySKILLS Education Toolkit: A Research-Based Tool

The ySKILLS (Youth Skills) project (2020–2023, funded by the European Union's Horizon 2020 Research & Innovation programme, under grant agreement no. 870612) aimed to enhance digital skills to promote

resilience in young individuals. Based on the premise that children play an active role in their development, the ySKILLS research examined how digital skills influence the opportunities and risks associated with ICT use among 12- to 17-year-olds in Europe (see https://ySKILLS.eu).

Over four years, the ySKILLS project employed various methodologies. One of its first steps was the development of the youth Digital Skills Indicator (yDSI), a measurement tool with 31 items that cover four dimensions of digital skills—each with functional and critical aspects—namely, technological and operational, information navigation and processing, communication and interaction, and content creation and production, the latter three also including digital knowledge items (Helsper et al., 2020). This tool was designed following an extensive academic and grey literature review and several validation practices and differs from existing international frameworks in that it is a measurement tool geared specifically towards young people (Helsper et al., 2020). The yDSI indicator was the basis for a longitudinal survey (2021, 2022, and 2023) in six countries (Estonia, Finland, Germany, Italy, Poland, and Portugal), in which the same group of students answered the same questions about their skills. In 2022, some students undertook performance tests (Van Laar et al., 2022). Furthermore, qualitative studies were conducted on the relevance of non-formal education in learning digital skills, the role of digital skills among adolescent refugees and young people with mental health issues, and misinformation and disinformation (Baptista et al., 2022).

One of the main objectives of the ySKILLS research was to develop insightful strategies for key stakeholder groups such as adolescents, teachers, and families. This objective reflects the importance of leveraging project results to share knowledge, strengthen research, and create tangible societal benefits (European Commission: Executive Agency for Small and Medium-sized Enterprises et al., 2019). Ethical and children's rights reflections influenced the decision to create an education toolkit and how it should be built. Being in charge of the communication, dissemination, and exploitation work package, the Portuguese team was responsible for developing the toolkit, working in close collaboration with the ySKILLS research team.

The toolkit, which is designed for non-academic use and targeted to facilitators who work with 12- to 17-year-olds, aims to promote digital skills by inviting young people to reflect on how those skills are defined and organized and how they can be improved. It can be used in educational settings and in informal environments such as youth associations or within families.

The development of the education toolkit involved careful consideration of normative (what content should be included) and substantive (how the content should be presented) criteria. This included a multi-phase process, starting with ySKILLS researchers reflecting on the content and determining which research tools could be used as educational resources. Table 1 provides an outline of the research instruments and results that informed each activity. The ySKILLS conceptual and methodological framework is present throughout the toolkit, notably in the theoretical integration of antecedents and outcomes of digital skills and online uses (e.g., Digital Map, Features & Impacts of the Internet) and in the definition, multidimensionality, and measure of digital literacy (Smahel et al., 2023), comprising both digital skills and digital knowledge items (e.g., Digital Skills under the Spotlight, Features & Impacts of the Internet, Navigation & Searching for Information, Content Creation, Communication & Interaction). Furthermore, considerable thought was given to how to present the activities in an engaging, appealing, and accessible manner. Interactive formats were prioritized to ensure adolescents could take part as active audiences.

Following this phase, we developed a prototype and sought input from children and teachers, working closely with the Portuguese Directorate General of Education. In webinars, we presented the first draft to young digital leaders (students conducting digital peer-to-peer sessions in their schools) and digital ambassadors (teachers focused on digital education). Both groups provided feedback, especially on technical aspects. This also helped us assess whether the activities were too challenging. It was the first step in evaluating the third criterion for the quality and effectiveness of science communication: performance. Finally, the Portuguese version was translated into English, reviewed by a proofreader, and then translated into the languages of the ySKILLS participating countries by the national teams, thus becoming available for use by anyone in those languages.

The ySKILLS Education Toolkit website has two modules, evaluate and execute, each containing three activities (Figure 1).

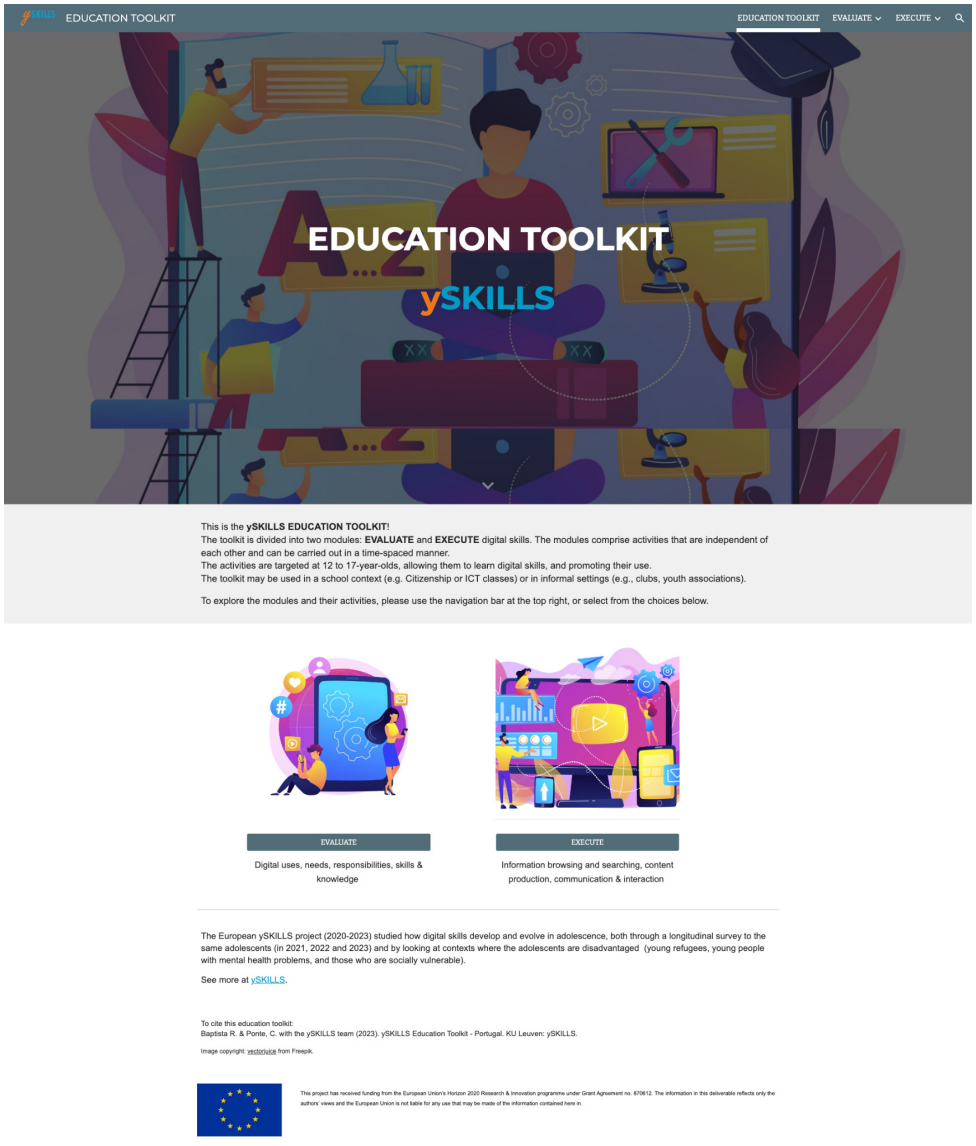

Figure 1. ySKILLS Education Toolkit homepage introducing the toolkit and the two modules. Source: Baptista et al. (2023).

The concept behind these modules was to create an environment where participants first reflect on their understanding of digital skills and then engage in tasks that enhance them (Table 1).

These modules prompt participants to reflect and create content while fostering critical thinking. This aligns with the evolving definition of digital skills, which has expanded from solely technical abilities to social and content creation skills (Van Laar et al., 2022).

Table 1. Description of the toolkit activities (module, name, duration, aims, and origin).

Module	Activity	Duration (minutes)	Aims	Origin
Evaluate	Digital Map	45'	— To reflect on digital uses, needs, expectations, and obstacles related to online uses and activities	Asset mapping of the qualitative study with refugee children and adolescents
Evaluate	Digital skills under the spotlight	90'	— To reflect on adolescents' digital uses — To recognize what digital skills are — To identify four groups of digital skills — To find out which groups are more or less reported by European teenagers — To discuss solutions for increasing the less reported skills	Research tools and results for digital skills items of the ySKILLS longitudinal survey
Evaluate	Features & impacts of the internet	30'	— To recognize some characteristics and impacts of the internet — To reflect on the ways these characteristics influence digital activities	Research tools and results for digital knowledge items of the ySKILLS longitudinal survey
Execute	Navigation & searching for information	45'	— To evaluate whether a website is trustworthy — To identify which information is more objective and reliable — To evaluate different search procedures	Research tools for the performance tests
Execute	*Content creation*	45'	— To identify sites with highly reliable and less reliable information — To evaluate Instagram posts — To design a presentation in digital format and disseminate it	Research tools for the performance tests
Execute	*Communication & interaction*	45'	— To identify problematic messages on a digital platform — To recognize what should not be shared on social media — To understand that communication approaches depend on the receiver	Research tools for the performance tests

Each activity has a session plan for facilitators, such as teachers, to provide a clear outline of the session (Figure 2). It also helps organize the session, manage time, and reduce the facilitator's workload when preparing for the session. The session plan includes objectives, time, materials, briefing, and step-by-step instructions for conducting the session. In some activities, a tips section was added.

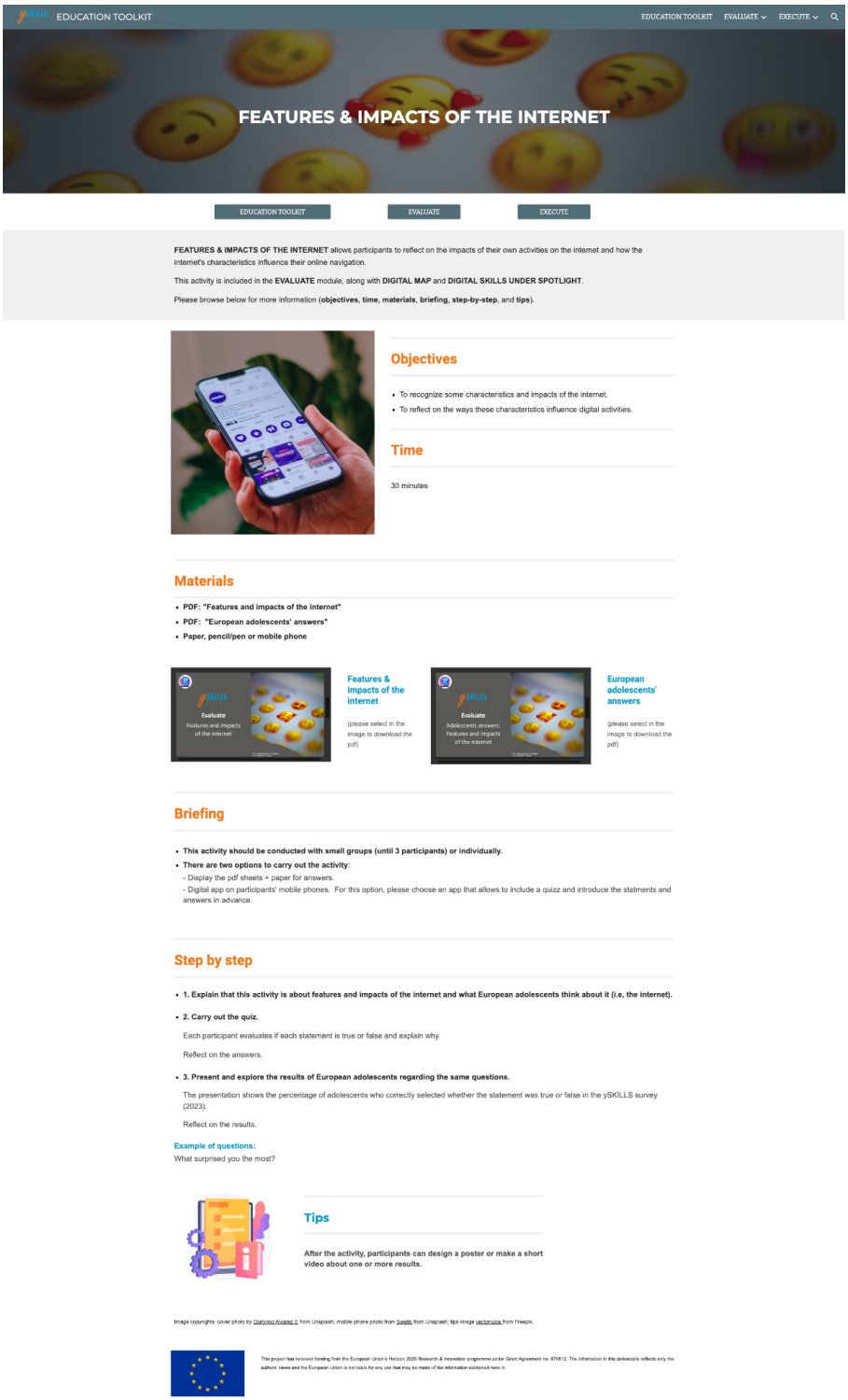

Figure 2. Example of a session plan in the ySKILLS Education Toolkit. Source: Baptista et al. (2023).

In line with our mission to integrate research with educational resources, we have striven to ensure that the content for each activity is engaging and relevant to adolescents. To that effect, we have drawn upon the insights of Bertemes et al. (2024) regarding textual characteristics. Our efforts have focused on avoiding scientific jargon, excessive technicalities, and unnecessary detail. We have incorporated visual aids, such as images and diagrams, to illustrate key concepts effectively. Additionally, we suggest pedagogical approaches rooted in active learning, fostering critical awareness and hands-on or discussion-based learning. These interactive formats ensure that the audience understands and actively engages with and interprets the findings, taking ownership of the information.

However, for digital learning to be fair and accessible to everyone, it is essential to have offline functionalities for the continuity of learning anywhere, anytime, especially in marginalized settings (UNICEF, 2023). Consequently, we have designed all activities to be conducted either online or offline, except the digital map activity, which is offline only. Furthermore, we provide the materials in PDF rather than PowerPoint presentations since the former does not depend on software updates. This ensures that the lack of internet connectivity or access to technology does not hinder activity performance.

To sum up, we have used science communication and pedagogical approaches to create a tool that teachers in various countries can easily use. By the end of the ySKILLS project, the education toolkit was accessible online in five languages. This dissemination has also been expanded beyond the countries that participated in the project, as evidenced by the UNESCO Aruba office's interest in implementing the toolkit in schools in Aruba.

4. Methods

After presenting and distributing the education toolkit, we were interested in discussing the potential and limitations of its use in classrooms with teachers, who are key beneficiaries of the toolkit. This allowed us to further elaborate on how teachers receive and appropriate this research-based tool (performative criteria) and to capture more generally how teachers consider the research-practice link.

Two schools not directly involved in the ySKILLS project were selected using a convenience-based sample method, and both agreed to participate in this discussion. Previous professional contacts facilitated the collaboration, and we ensured geographical variability: both were high schools in urban settings, one located in the metropolitan area of Lisbon (school A) and the other in the countryside (school B). Our main contact in each school—the school principal in one case and someone close to the school board in the other—selected and recruited the participating teachers based on our single criterion of teaching level, to match the appropriate age of the children for whom the activities were designed (lower secondary). The school principals promptly approved the initiative, which showed the strategic relevance of this theme, and all teachers were interested and agreed to participate.

We began by organizing an initial Zoom meeting where we presented the education toolkit and the instructions for the activity: Each participant had to choose at least one of the six activities and explore it independently in their classrooms.

A few weeks later we conducted focus groups in the two school settings. Focus groups are defined as a data collection method through group interaction on a subject introduced and conducted by the researcher as an

interviewer (Morgan, 1996). Due to the approaching end of the school year and a set of personal misfortunes that overlapped with the data collection, the focus group in school A involved only two teachers; the school principal was also present. Table 2 presents the main characteristics of the teachers.

Table 2. Characteristics of the participants.

School	Sex	Age	Years of teaching experience	Teaching area
A	F	47	+/−20	Citizenship education & geography
A	M	28	4	Citizenship education & geography
B	M	49	21	Geography
B	M	42	15	Citizenship education
B	M	46	10	Information & communication technology
B	M	31	3	History
B	F	55	32	Citizenship education
B	F	49	8	Physics & chemistry

The initiative mobilized eight teachers (five male and three female). Most taught subjects directly relevant to the development of their students' digital skills—ICT and citizenship education—and (often simultaneously) subjects within the social sciences—geography (three) and history (two). Three teachers had less than 10 years of experience, while three others had more than 20 years.

The discussion followed a semi-structured script around five dimensions: (a) preparation, (b) implementation of the activity, (c) student feedback, (d) reflection on the education toolkit, (e) discussion on the relationship between research and education. Each focus group session took one hour. The audio was recorded, and the main results were analysed based on the dimensions mentioned above.

5. Education Toolkit in Action: Teachers' Perspectives

At the time of this initiative, three teachers had not worked on digital skills in their classrooms. All but one chose just one activity. Features and Impacts of the Internet (6 teachers), from the evaluation module, was the most chosen. In school A, each teacher chose one activity from the execute module: Communication and Interaction and Navigation and Searching for Information. The latter was also chosen by one teacher in school B. Around 200 students participated, all from the third cycle of basic education (grades seven to nine).

5.1. Preparation

All teachers deemed the first online meeting useful for getting to know each other and gaining a general understanding of the toolkit. They also considered the resources and session plans to be clear.

To ensure they achieved their goals for the final part of the school year, and amidst many other tasks, the choice of activity was mainly driven by ease of implementation. Nevertheless, some tried to involve students or made an extra effort to try more than one activity: "I presented the themes that were on the ySKILLS portal and the matter was negotiated with the students, they were the ones who chose" (F, 55, school B); "I tried to do one from each [module] to try it out. As this was already at the end of the year, in the last week, it was only possible to apply it in two classes" (F, 47, school A).

The majority complemented the activity with an interactive part, as suggested in the session plan (Kahoot or Google forms). These adaptations were meant to captivate students, even if they involved more work:

> I created the form. I put in the questions, with images, made a print screen of all the images, that's it…it took up a little more time…because I also wanted it to be a little more attractive for the students when they were answering the questions. (F, 47, school A)

Some perceived fragilities in the students' digital skills and certain expectations about their reactions were also presented as reasons to justify the choice of activity: "Navigation and Information…so that they realize the big mistakes they make when doing their homework, and this was clear when they immediately clicked the first link that appeared" (F, 49, school B); "I chose Navigation and Information. That's because I think it is the type of thing that is most dangerous for them, and they should pay attention, even in homework and all, verify the sources, check if everything is ok" (M, 28, school A); "they use social networks more and more, and they don't have a perfect understanding of the information that is on the internet" (M, 42, school B).

The general perception was that this type of activity was better suited for a general subject, such as Citizenship Education, rather than a tool whose contents could be changed to serve other subjects. This is why an immediate application was valued: "In geography, there is no time to do this, but these are good activities to do in Citizenship Education" (M, 49, school B). Nevertheless, some teachers identified points of contact with other subjects, like physics and chemistry.

5.2. Implementation

The Navigation and Searching for Information activity was praised for its pedagogical and civic value. Class debates or group discussions shone a light on certain issues: "Confusion naturally arose because they didn't get the same answer" (F, 49, school B); "immediately there were little conversations, they were trying to find out a bit more" (M, 28, school A). Some functional constraints were also identified:

> I noticed that you can't use Google's search tool on a smartphone. And I was confused myself, I was there trying to no avail. Then I switched to the computer and was able to do it. But they [the students] hardly use the computer. They even have difficulties using the computer. (M, 28, school A)

No other logistic constraints were reported, which indicates that those classes were used to employing digital tools for learning. However, a lack of understanding was identified when implementing specific activities, as was the case with two questions in the Communication and Interaction activity that raised doubts due to unclear wording or a confusing image.

In the Features and Impacts of the Internet activity, where students were confronted with questions derived from the yDSI knowledge items, teachers appreciated the explanations provided in the slides, which facilitated the moderation of the discussion.

The materials and time allocated were seen as adequate and sufficient for the target population. The themes covered were considered pertinent, topical, and even related to other subjects in the curriculum (for example, Greta and global warming, telecommunications, etc.), although in school B the interaction between teachers

pointed to the emergent need to discuss the use of artificial intelligence: "[AI use] is increasing considerably in homework related to natural disasters; some will do a search on meteorological and hydrological drought when it is on the manual, for example, they will go to ChatGPT" (M, 49, school B).

Some teachers realized that their students' digital skills did not meet their expectations:

> I thought that they went further, that they knew more. (F, 47, school A)

> What really surprised me was the fact that they realized [through the activity] that not all the information they search for is actually effective. I find it strange that in the eighth year of schooling they think everything that is there [is right]. (F, 49, school B)

By contrast, the teacher of a "very good" class (M, 42, school B) stated that students were quite at ease with the questions. In the discussion, it was suggested that the toolkit could be improved by introducing different levels of complexity.

Despite some fears of distraction or excessive competitiveness to get the answers right, overall the toolkit was welcomed as a tool that motivates students to pay attention and favours an educational use of smartphones: "They were curious…as they answered the questions….Even to see each other's responses afterwards" (F, 47, school A); "they really liked it because they used their smartphones to do activities they enjoy. And then they discussed them. In the following class they asked me if we were going to continue" (M, 28, school A).

5.3. Reflection on the Education Toolkit

Overall, participating teachers expressed their appreciation for the activity and regretted not having had more time to explore further; they also manifested the desire to continue to use the toolkit in the following academic year. The active learning nature of the activities was highlighted:

> I think the usefulness of this toolkit is precisely to get students to reflect on these practices. This is largely based on questions and little activities, but then they can debate among themselves and reflect on these practices. It is not just listening to how it is done, but also reflecting in practice. (F, 47, school A)

> In citizenship classes, I covered [these skills] but it was more theoretical because I did not have activities. Here we have all the practical part, which I think is essential because there is a big difference between speaking, listening, and doing. (M, 28, school A)

The ICT teacher (M, 46, school B), who frequently creates his own applications and gaming solutions, expressed some criticism regarding the Features and Impacts of the Internet activity, which is based on questions and answers, followed by debate. In his opinion, the suggested adaptation to a Kahoot is not enough and not even desirable, because the result is "that competition, for them [the students], is about being faster, and in the end it is not the fastest who gets it right." For this reason, he strongly suggested the necessity of "a set of platforms prepared to be able to really show what is happening," including the future consequences of what is being done online now, using simulations to that effect.

One of the suggestions to improve the education toolkit was to increase the avenues for feedback from the people who use it, for example, by embedding a form in each activity or by providing pre- and post-questionnaires to assess what was learned after implementing the activities.

5.4. Relating Research and Educational Practice

In school B, despite several attempts to reformulate, the majority did not understand the question associated with the relationship between evidence-based knowledge and its exploration for educational practices. Thus, almost everyone dissociated themselves from the question and focused on the practical and functional dimension of its wording: "I am not going to do a search [on how] to take photographs and I am not interested in doing a TikTok with students, as this is part of their skills nowadays" (M, 49, school B).

Most teachers revealed that they have no contact with nor look for research in a transdisciplinary domain such as digital skills. When challenged to imagine how to establish this link, they considered that the possibilities were limited to offers of formal training, regular support, and monitoring or information directly channelled by superiors. Interestingly, the benefits of this relationship based on exchange and shared practices were emphasized primarily by the members of the school management team:

> It is interesting that the team that designs this toolkit and these materials can establish a relationship with those who apply them. (Principal, school A)

> It is good to have access to various perspectives…for ourselves; even though it is not for us to use this in class, it is for us to train as teachers and often adapt our teaching practice afterwards….I am here because even though I haven't read any of this I think this topic is extremely important and this education for digital literacy is essential….How to do this, I don't know either, but how can we facilitate this bridge? Indeed, not everyone has the time, availability, or interest to go look for books. (Contact at school B)

6. Final Remarks

In this article, we have critically examined a research-based tool developed within the ySKILLS project and designed to promote digital literacy and skills among adolescents and to be used, inter alia, by teachers in educational settings. The ySKILLS project's theoretical and conceptual models, tools, and results informed the content of the toolkit and its design, centring it on evaluation and execution activities. This toolkit differs from existing frameworks that aim to guide teachers to enhance students' digital skills in that it encompasses several dimensions designed specifically for young people (yDSI), considers risks as well as opportunities, and provides ready-to-use yet adaptable activities.

To analyse how teachers receive and appropriate the ySKILLS Education Toolkit, we challenged professionals from two schools to try it in their classrooms. The main limitation of this study is its restricted scope, as it involved only eight teachers (who applied the activities with around 200 students) in Portugal. The results would certainly be enriched if the experience were to be replicated in more diverse settings or in other countries. Nevertheless, the discussion with teachers raised some pertinent questions regarding the performative aspects at play and for the purpose of capturing more generally how teachers perceive the research-practice link.

The performative criteria for assessing the quality and effectiveness of science communication (Lafrenière & Cox, 2013) are directly related to how teachers receive and appropriate the education toolkit, as they deal with aspects such as the accessibility of the toolkit, the level of engagement it elicits, and how it supports a better understanding of certain issues. The high degree of applicability of the education toolkit was the most appreciated feature. Indeed, it saves teachers time when they are usually overwhelmed and provides rare pedagogical resources. Moreover, toolkit activities were seen by teachers—and students—as enjoyable, engaging, and useful. Other potentialities relate to a coordinated strategy to focus on this area or its use by teachers across several subjects, although this would entail more work on adaptation.

Amongst the limitations, they identified minor issues with the clarity of certain activities and instructions, particularly regarding devices or browsers. The most critical interviewees directed their comments at the format of the activities, which in their opinion should be more experimental, although it bears noting that they only tried one of the modules. This shows some risks in the design option to make each activity independent, which can lead to some teachers losing sight of the way the entire kit is structured.

While the relevance of the contents was highlighted, they do not include activities directly related to artificial intelligence, and we can imagine how this need for constant updating constitutes another potential limitation; the need for flexible frameworks has already been identified in the literature (Ilomäki et al., 2023). Some of the suggestions for improvement relate to the inclusion of mechanisms for user feedback, to which we can add the evaluation of the toolkit's impact on young people's digital literacy and the introduction of different levels of complexity.

Globally, teachers' perception of the relationship between research and educational practice is more instrumental and linear: they prioritize ready-to-use materials and see themselves as "implementers" following interventions or training. They do not actively seek out research but do value maintaining close relationships with the academic sector. Therefore, we emphasize that evidence-based tools should be designed to be used autonomously while also being contextualized, readapted, and transformed to meet different needs, allowing for different uses. The presence of researchers in the field seems to be a desirable way to strengthen the connection with education, facilitating science communication and promoting a conceptual use of research (Welsh, 2021) through shared discussions and reflective practices (Biesta, 2007).

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Conflict of Interests

The authors declare no conflict of interests.

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ARTICLE

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Unveiling Disability Empowerment: Evaluating ICT Skill Enhancement Initiatives in Indonesia

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Abstract

This study examines the role of information and communication technology (ICT) skill development programs, such as the Digital Talent Scholarship and ICT Jamboree, in empowering people with disability across Indonesia. Grounded in empowerment theory, it investigates how these programs contribute to personal autonomy, economic engagement, and social inclusion. The research focuses on participants' perceptions of the impact of ICT training on their independence and social integration. It also identifies challenges in applying ICT skills in daily life, including barriers to employment and limited access to assistive technologies like Braille displays and hearing aids. Through a qualitative approach—using semi-structured interviews and focus group discussions with 99 participants from diverse people with disability groups—the findings reveal significant improvements in self-confidence, digital literacy, and participants' ability to overcome employment and online communication challenges. While ICT shows potential to reduce social isolation and foster digital inclusion, disparities in proficiency and access to adaptive tools remain. The study emphasizes the need for more tailored interventions and advocates for increased funding, better accessibility, and stronger public-private partnerships to advance disability inclusion through ICT, extending beyond Indonesia to Asia and the Middle East.

Keywords

disability; empowerment; evaluating; ICT skills; ICT training; Indonesia; social inclusion

1. Introduction

Indonesia, as the world's fourth most populous country and an archipelago nation, faces unique challenges in addressing social and health issues, including among people with disability (PwD). Disability in Indonesia

is a complex issue requiring special attention from various sectors. According to the latest data from the Badan Pusat Statistik (BPS; Central Statistics Agency), in 2022 there will be approximately 22.5 million PwD in Indonesia, up from 16.5 million in 2021 (Kominfo, 2024). This introduction will discuss the demographics of disabilities in Indonesia, the challenges faced by PwD, and the efforts of the government and society to improve their welfare and social inclusion.

The population of PwD in Indonesia is spread across all provinces, with varying prevalence. According to data from BPS, most PwD are in rural areas. In 2022, it was recorded that around 720,748 PwD were working, which is 0.53% of the total working population in Indonesia. Of this number, 445,114 are men, and 275,634 are women (BPS, 2022). This figure shows a significant increase compared to the previous year, reflecting better recording and empowerment efforts for PwD. Indonesia has made significant strides in the area of disability rights. It ratified the United Nations Convention on the Rights of Persons with Disabilities in 2011, demonstrating a solid commitment to protecting and advancing the rights of PwD. Indonesia has also enacted laws related to disability rights, including Law No. 8 of 2016 on PwD. Through this law, Indonesia strives to equalize opportunities for PwD everywhere. Indonesia also monitors the equality of PwD through the Sustainable Development Goals.

Access to education for children with disabilities in Indonesia is still limited. Inclusive schools, which should provide friendly education for all children, are not evenly distributed throughout the region. Many children with disabilities lag in education due to a lack of facilities, trained teachers, and appropriate support (UNICEF, 2023). This gap affects the academic and social development of children with disabilities, limiting their future opportunities. Children with disabilities in Indonesia encounter significant obstacles in accessing education due to various factors, such as the lack of facilities, trained teachers, and specialized support. Historically, children with disabilities had the option to attend special schools, known as Sekolah Luar Biasa, which were designed to address specific disability categories, thereby segregating them from mainstream education (Rofiah et al., 2021; Sujarwanto et al., 2023). However, the research underscores the importance of integrating children with disabilities into mainstream schools to ensure equal educational opportunities (Crea et al., 2022; Hamenoo & Dayan, 2021; Notoprayitno & Jalil, 2019).

Technology plays a vital role in enhancing social inclusion for PwD. The Indonesian Government has initiated digital literacy programs tailored for PwD, such as podcast classes and training on utilizing digital technology (Kominfo, 2024). These programs aim to empower PwD with technological skills to help them in their daily lives and work. The Digital Talent Scholarship and Information and Communication Technology (ICT) Jamboree, organized by the Ministry of Communication and Informatics (Kominfo), are crucial to the Indonesian Government's efforts to enhance digital literacy across society, including for PwD (Kominfo, 2024).

Meanwhile, the ICT Jamboree emphasizes digital inclusion by offering an interactive space for participation. Through training sessions and competitions, PwD can directly engage with technology and a broader community, fostering social skills and strengthening their confidence in utilizing technology to support their social integration. During the ICT Jamboree, the training materials provided to PwD included Microsoft Office, internet usage, photoshop design, public speaking, and copywriting. Social inclusion is a crucial aspect of the lives of PwD, and initiatives like the ICT Jamboree play a significant role in addressing the stigma often faced by PwD by demonstrating their ability to compete and contribute significantly using

technology. Such initiatives promote the development of a more inclusive society where technology bridges new opportunities and fosters broader participation across all population segments (Kominfo, 2017).

This article is drawn from a more extensive mixed methods study that explored how improving ICT skills impacts PwD by involving parents, educators, and the disability community as participants. The study used a combination of qualitative and quantitative research methods to gather a comprehensive understanding of the topic. In this manuscript, we present findings from qualitative data about the experiences of ICT trainees. We included their experiences during and after completing ICT skills training. In Section 5, we consider young people's experiences in the context of independence in everyday life and whether these experiences differ from those reported in previous qualitative research. The guiding research question for this study is:

> RQ1: How do PwD perceive the impact of ICT skills training on their independence and social inclusion?
>
> RQ2: What challenges, including barriers to employment and access to assistive technologies, do they face in integrating ICT into their daily lives?

In addressing the research questions, this study seeks to examine the role of ICT skills training in shaping the experiences of PwD. The research aims to uncover how these training programs influence their ability to engage in digital environments and their broader social and professional integration by focusing on their perspectives. Furthermore, the study intends to identify and analyze the barriers individuals with disabilities face when applying ICT daily, particularly about employment opportunities and access to assistive technologies. The objective of this study is to (a) explore how PwD perceive the impact of ICT skills training on their independence and social inclusion; and (b) identify the critical challenges PwD face integrating ICT into their daily lives, including employment barriers and access to assistive technologies.

Specifically, it explores how these training programs enhance their daily lives and foster independence. By investigating the contributions of these programs to social inclusion and individual empowerment, this study aspires to provide valuable insights into the experiences of PwD, highlighting the essential role of ICT skills in enhancing their quality of life.

2. Literature Review

Empowerment theory posits that empowerment is a process through which individuals gain greater control over their lives, resources, and decision-making capacities. This process is particularly critical for PwD, as it fosters a shift from dependency to autonomy by enhancing their capacity to participate in social, economic, and political spheres. Central to this theory is the notion that empowerment is both an individual and collective process, requiring access to resources, opportunities, and support systems that enable individuals to make informed choices and assert their rights. In the context of ICT skill programs, these initiatives play a transformative role, providing essential technological tools and competencies that enable PwD to overcome structural barriers. By equipping them with the skills necessary to navigate and utilize digital technologies, these programs facilitate greater access to information, employment opportunities, and social networks—offering a hopeful vision for a more inclusive and empowering future for PwD.

Empowerment theory is a fundamental concept in social work and disability support. It focuses on enabling individuals to gain control over their lives and improve their social functioning and quality of life. Social workers in the disability field often practice empowerment at the micro-level due to structural and policy constraints. They face obstacles that impede the complete application of empowerment approaches, affecting their ability to empower clients effectively (Tören & Açan, 2024). Empowerment for children with disabilities involves recognizing their right to express views and participate in decisions that affect them. Overprotection can limit their empowerment, and a dynamic empowerment model is suggested to address these complexities (Andersen, 2022). Furthermore, the decision to disclose disability at work is influenced by personal, organizational, and legal factors. Empowerment can be achieved through supportive environments and policies, although there can be inequalities in how these are applied (Richard & Hennekam, 2020).

ICTs are powerful tools that significantly empower PwD in Asia and the Middle East. They open doors to skill development and employment opportunities, providing access to educational resources and skills training that are essential for employment. For instance, in Bangladesh, ICT training has been a beacon of hope, enhancing the social and economic freedoms of people with visual impairments and providing them with educational and work opportunities (Hasan et al., 2018). In Qatar, an e-readiness assessment tool identified gaps in ICT infrastructure in educational institutions, highlighting the need for inclusive digital environments to support the skill development of PwD (Othman et al., 2023).

ICTs play a crucial role in creating new employment forms that are accessible to PwD. In China, digital work such as online gaming, e-commerce, and software development has opened employment opportunities for people with physical impairments. However, these jobs often need more formal protections and benefits (Qu, 2020). Using assistive technologies and accessible ICTs can break down barriers to socioeconomic participation, making it easier for PwD to engage in various economic activities (Samant et al., 2012). Creating inclusive digital environments is a crucial factor, as well as underlining the importance of their work in this area.

The use of visual educational apps on tablets has proven effective in teaching essential ICT competencies to students with intellectual disabilities, as seen in a study conducted in Ghana, which can be extrapolated to similar contexts in Asia and the Middle East (Bayor et al., 2023). Effective policies and legislation are crucial for adopting and implementing accessible ICTs. The comprehensive ecosystem approach, which includes supportive legislation, policy, infrastructure, and financing, is essential for sustainable access to ICTs for PwD (Samant et al., 2012).

ICTs play a crucial role in promoting the employment of PwD by providing tools that enable them to perform job-related tasks efficiently. It includes using assistive technologies in the workplace to improve usability and integration (Gastaldi et al., 2015)—significantly enhancing skill development and employment opportunities for PwD in Asia and the Middle East. ICTs result from their ability to provide access to education, assistive technologies, and supportive policies. However, the success of these initiatives depends on the comprehensive alignment of various ecosystem components, including government policies and infrastructure (Gastaldi et al., 2015; Hasan et al., 2018; Samant et al., 2012; Zheng et al., 2023).

Digitization is recognized as a fundamental element in creating opportunities for social inclusion, particularly for PwD, enabling them to enjoy an improved quality of life (Agren et al., 2023; Alexopoulou et al., 2021;

Kerras et al., 2022; Mohammad & Aldakhil, 2024; Tsatsou, 2020). Social networks allow them to make their interests visible, take part in the digital environment, and interact with their audience, being a positive influence that promotes respect for diversity (Bonilla-del-Río et al., 2022; Martin et al., 2021; Usca & Vindece, 2020; Żuchowska-Skiba, 2021). Moreover, digital technologies in inclusive education can potentially integrate PwD into society's social and economic fabric (Avanesyan, 2020; Shumilova et al., 2022; Yaskevich, 2021).

Tele-rehabilitation utilizing the internet positively impacts the physical rehabilitation and social integration of adolescents with visual or hearing disabilities (Gefen et al., 2021; Guo et al., 2023; Senjam et al., 2021). Furthermore, participation in technology design activities has been found to enhance the digital inclusion of PwD by improving digital skills, displaying competence, increasing interest in technology use, and influencing technology adaptation (Li et al., 2023; McCampbell et al., 2021; Safari et al., 2023). Studies have shown that ICTs foster social connectedness among PwD, highlighting the potential of these technologies to promote inclusivity (Bao et al., 2023; Barlott et al., 2019). The digital inclusion of PwD is crucial in today's technology-driven world, emphasizing the need for accessible and inclusive digital support practices (Chadwick, Richards, et al., 2023; Seale, 2022; Weber et al., 2022). This work is not just important; it is essential for creating a more inclusive society, and digital technologies play a significant role in this transformative process.

3. Method

3.1. Study Design

This qualitative study is part of a broader mixed-methods research project that investigates the impact of ICT skills training on the independence and social inclusion of PwD in Indonesia. The study's design reflects a combination of purposive sampling, semi-structured interviews, surveys, and focus group discussions (FGDs). The selected participants were drawn from six provinces, encompassing 99 individuals who had completed ICT training programs. Interviews were conducted with all 99 participants, including individuals from two focus groups of 13 and 17 participants. The data collection process was designed to ensure inclusivity, accessibility, and depth, allowing for a comprehensive understanding of participants' experiences.

The use of purposive sampling in this study is aligned with established qualitative research practices in disability studies, where researchers prioritize participants with characteristics essential for exploring specific phenomena (Conner et al., 2023). By focusing on PwD aged 19–39 who had not yet entered the workforce, the study captures crucial transitional experiences from ICT training to employment. This approach ensures that the data reflects the lived realities of diverse individuals with varying degrees of experience and engagement in the workforce.

3.1.1. Theoretical Framework and Instrument Development

The development of data collection instruments, including surveys and interview questions, was guided by empowerment theory (Zimmerman, 1995). Empowerment theory is grounded in the understanding that marginalized groups, such as PwD, often experience systematic exclusion and disempowerment due to structural barriers within society. These barriers manifest in various forms, including limited access to education, employment, social services, and infrastructure, constraining their ability to live independently

and participate fully in societal life. Structural obstacles are not simply individual challenges but are entrenched within societal norms, policies, and institutional practices that inadvertently perpetuate inequality. For PwD, these barriers can lead to social isolation, dependency, and reduced opportunities for self-determination (Zimmerman, 1995). The instruments were developed in consultation with an advisory panel and informed by academic literature and insights from the Research and Development Agency of the Indonesian Ministry of Communication and Informatics. This theoretical grounding ensured that the survey and interview questions were relevant and comprehensive, addressing key themes such as transition planning, post-training activities, and support mechanisms.

Additionally, the qualitative aspects of the study, including semi-structured interviews and FGDs, were informed by Biklen and Bogdan's (1977) interactionist model, which emphasizes building rapport with participants and adapting the research process to their cognitive and communication abilities. Before conducting interviews, researchers explained the study's objectives in accessible language and provided participants with clear, detailed information regarding consent. This adaptive approach allowed participants to engage fully in the discussions and ensured the authenticity of their responses.

3.1.2. FGDs and Semi-Structured Interviews

FCDs and semi-structured interviews align with Morgan's (1997) framework on focus groups as a qualitative research tool. Focus groups are particularly effective when exploring collective experiences and shared insights among participants. In this study, the FGDs provided a platform for participants to discuss their experiences in a supportive group setting, while semi-structured interviews allowed for a deeper exploration of individual narratives. This dual approach enabled a more nuanced understanding of how ICT training influenced participants' lives, particularly regarding their aspirations for independence and employment.

Two focus groups involving 13 and 17 participants were conducted to ensure a broad and diverse data set. Including semi-structured interviews with all 99 participants ensured saturation, with recurring themes identified across the different data sources. Guest et al. (2006) noted that saturation is often reached with a relatively small number of participants in qualitative research, mainly when focusing on specialized populations such as PwD. Nevertheless, the larger sample size in this study strengthens the reliability and validity of the findings.

3.1.3. Ethical Considerations and Consent

Ethical considerations were central to the study design, particularly given that the participants were PwD. If participants could not provide consent independently, informed consent was obtained from caregivers or legal guardians. Consent processes were carefully explained, and participants were reassured of their right to withdraw at any point during the study. Pseudonyms were used to protect participants' identities, ensuring confidentiality throughout the research. In line with best practices in disability research, all participant materials—including surveys and interview guides—were developed in accessible formats, ensuring participants could fully engage with the study (Biklen & Bogdan, 1977).

This approach underscores the study's commitment to inclusivity and respect for participant autonomy. To gain a more comprehensive understanding of young individuals' experiences with transition planning,

their departure from ICT skills training, and subsequent engagement in post-training activities, the advisory group developed a set of qualitative survey and interview questions. These were informed by relevant academic literature and critical insights from the Research and Development Agency of the Indonesian Ministry of Communication and Informatics (see Table 1). The online survey, administered via the Qualtrics platform, included demographic queries, structured response options, and open-ended qualitative questions. This report focuses exclusively on the responses to the qualitative questions. The sample was restricted to individuals aged 19 and above who had completed ICT competence training.

Table 1. The interview and focus group questions.

Topic	Questions
The role of ICT training in enhancing technological skills, confidence, and employability for PwD	1. What challenges did you face in ICT training? 2. How did class size affect your learning? 3. Did the teaching method meet your needs? 4. How could the program better support learners? 5. What tools would have improved your experience?
Enhancing the empowerment of PwD via ICT training: An exploration of skill acquisition, confidence enhancement, and career advancement	1. How has your confidence in tech changed? 2. What skills from training are most valuable? 3. Can you share a moment when your skills helped? 4. Has the training improved your job prospects? 5. How has training affected your social confidence?
The influence of community support, personal attributes, and assistive technologies on ICT skill development and independence among PwD	1. How has community support helped your ICT skills? 2. What personal qualities have aided your progress? 3. How have role models influenced your independence? 4. How do assistive technologies support your ICT use? 5. What challenges have you faced, and how was support helpful?

Notes: Prompts and additional questions were employed to facilitate discussion on each topic; most survey items were presented in a fixed-response format, accompanied by textual answer options.

3.1.4. Data Collection

The data collection process involved 99 individual interviews and two FGDs. Following one of the focus groups, two participants opted to participate in individual interviews. The interviews typically ranged from 30 to 45 minutes in duration. Sometimes, parents were present at the participants' request to offer clarification when necessary. The focus groups, consisting of 13 and 17 participants, were held at different service provider locations in Jakarta and lasted approximately 1.5 to 2 hours each.

Two researchers facilitated each session—one focused on guiding the discussion, while the other observed, took notes, and ensured the inclusion of all participants. Support workers were also available to provide clarification and assist participants in recalling essential experiences relevant to the study. With the consent of participants, all interviews and focus groups were digitally recorded and later transcribed verbatim by a professional transcriptionist.

3.2. Analysis

Data collected from interviews, FGDs, and anonymous text responses were analyzed using NVIVO software. A reflexive thematic analysis approach, as described by Braun and Clarke (2019, 2021), was used to identify and organize significant patterns in the qualitative data. Analysis began by closely examining the transcripts to ensure the researcher fully understood the data. Each interview transcript was coded inductively to maintain the authenticity of the youth participants' perspectives. These codes were developed collaboratively through team discussions. Once no new codes emerged, the researcher grouped the data based on aligned conceptual similarities. Through ongoing discussions, the research team reached a consensus on standard codes that best described participants' experiences in the ICT training program.

Further analysis resulted in the identification of initial themes and subthemes. A thematic map was then created to visually represent potential themes and their interrelationships (Braun & Clarke, 2021). These initial themes were generated based on a comprehensive assessment of the data, research questions, and primary objectives of the study. Braun and Clarke's (2019) framework was used to refine and define the themes, leading to a written interpretation of the study findings. Due to the small sample size, no statistical analysis was conducted on the survey data.

4. Results

The data provided here are based on the responses of 99 young people aged 19 to 39, comprising 45 females and 54 males. Table 2 displays the features and demographics that we gathered from all participants.

Table 2. Characteristics of the participants.

Age Group	Physical Disability	Visual Disability	Hearing Disability	In Disability Service	Studying	Working	Volunteer	Doing Nothing
19–25	7	9	6	17	2	2	1	0
26–32	8	8	9	19	2	1	2	1
33–39	18	17	17	42	3	4	3	1
Total	33	34	32	78	7	7	6	2

Notes: In disability service, studying, working, volunteering, doing nothing—activities after leaving the ICT program.

The focus groups were organized with key stakeholders, including PwD, ICT training program evaluators, and educational psychology experts. The data collection process took place across multiple regions, including Jakarta (Special Capitol Region), Palembang (South Sumatra), Yogyakarta (Special Region of Yogyakarta), Balikpapan (East Kalimantan), and Manado (North Sulawesi). During the informant interviews, the teams were supported by translators, most of whom were teachers or parents of PwD.

To provide a structured overview of the qualitative findings, the emergent themes and their associated categories are presented in Table 3.

Table 3. Themes and categories.

Themes	Categories
Overcoming challenges in ICT skill training	1. Identifying issues: Addressing critical challenges encountered by participants in ICT skills development programs 2. Bridging knowledge and skills gaps: Implementing targeted solutions to enhance ICT competencies
Building confidence and competence through ICT participation	1. Self-confidence: Enhancing belief in one's abilities 2. Enhancing resilience: Strengthening confidence in overcoming difficulties
Empowering PwD through coordinated support and autonomy	1. Community and family support: Creating inclusive environments through community awareness and engagement with educators and family members as key facilitators 2. Internal and external factors influencing the independence of PwD

4.1. Theme 1: Overcoming Challenges in ICT Skill Training

4.1.1. Identifying issues: Addressing Critical Challenges Encountered by Participants in ICT Skills Development Programs

Despite the substantial resources provided by the ICT training program, participants consistently identified numerous challenges that significantly impeded their learning experiences. These challenges, such as accessibility barriers, the need for differentiated instruction, and the impact of classroom dynamics on engagement, are not just obstacles but real struggles that the participants face.

One critical accessibility issue highlighted by participants was the absence of Braille materials for visually impaired individuals. Mahmud, a visually impaired trainee, poignantly expressed his frustrations, stating, "A blind person like me just needs instructions because I cannot see. It was too noisy, so it is hard to listen" (Mahmud, interview, February 11, 2023). This statement underscores the need for auditory and tactile resources to create an inclusive learning environment. The lack of Braille materials hindered Mahmud's engagement with the content and revealed a systemic oversight in accommodating PwD. Participants in a FGD echoed Mahmud's sentiments, emphasizing the necessity for enhanced provision of adaptive learning tools. For instance, a participant named Rina noted, "Without proper Braille materials, we are left behind. It is not just about the lessons; it is about feeling included" (Rita, FGD, May 16, 2023). Such insights highlight the potential for improving accessibility by introducing adaptive learning resources, which could empower visually impaired participants to engage more effectively.

Similarly, accessibility issues were evident for Sony, a deaf participant, who experienced difficulties related to classroom seating arrangements. He remarked, "I sit in the rear row, so it is hard to see the expressions and sign language" (Sony, interview, March 15, 2023). This concern reflects a broader issue regarding the physical learning environment and its implications for effective communication. For deaf learners, visual cues, including sign language, are essential for comprehension. In the same FGD, another participant, Amir, shared, "When the class is large, and I cannot see the instructor or the sign language interpreter, I feel lost. Smaller

classes or better seating arrangements would help immensely" (Amir, FGD, May 16, 2023). The challenges posed by large class sizes—often exceeding 30 participants—restricted access to these critical visual cues, reinforcing the urgent need for strategies that promote smaller class sizes or prioritized seating arrangements that enhance visibility and communication.

Moreover, participants highlighted the necessity for differentiated instruction tailored to diverse learning needs. Fatima, another participant, articulated this concern, stating, "The pace of the class is often too fast for those of us who need more time to grasp the concepts" (Fatima, interview, March 12, 2023). It reflects a broader consensus among participants that a one-size-fits-all approach to instruction must accommodate varying proficiency levels and learning styles. The FGD participants collectively suggested, "We need more personalized support and varied teaching methods to cater to different learning speeds" (FGD, May 16, 2023). Implementing differentiated instructional strategies could significantly enhance engagement and comprehension among all participants, particularly those with varying abilities and backgrounds.

The challenges in ICT skill training programs are complex and interrelated. Offering adaptive resources, enhancing classroom dynamics, and implementing differentiated instruction is crucial to creating an inclusive and effective learning environment. Incorporating participants' feedback can help better address diverse learner needs, advancing educational equity.

4.1.2. Bridging Knowledge and Skills Gaps: Implementing Targeted Solutions to Enhance ICT Competencies

The ICT skill training program revealed diverse proficiency levels among participants, from complete beginners to advanced users. This disparity underscored the need for differentiated instruction, a critical factor in ensuring that the program meets the varied learning needs of its participants. The one-size-fits-all approach to training failed to challenge advanced learners while simultaneously overwhelming beginners, highlighting the necessity for a more tailored instructional strategy.

Fikri, an advanced learner, expressed dissatisfaction with the curriculum, stating, "The class was too easy for me. I already knew how to use the programs they were teaching" (Fikri, interview, March 21, 2023). His frustration points to a broader issue within the program: a lack of differentiation in instruction. A more effective approach would involve creating tiered levels of training, allowing participants to be grouped according to their pre-existing knowledge and skills. In a follow-up FGD, advanced learners emphasized the need for challenging content that could push their skills further. "We could have benefited from more advanced modules or independent projects. The basics were repetitive for us," noted Fikri (FGD, May 16, 2023). Implementing a multi-tiered training system could provide more stimulating learning opportunities for advanced participants, keeping them engaged while still catering to beginners.

Conversely, the experiences of beginner participants demonstrated a need for more excellent instructional support and adaptability. Rina, a deaf participant, shared her struggles, stating, "I needed more time to understand the instructions, especially because I rely on visual aids and lip reading" (Rina, interview, March 25, 2023). It highlights the importance of pacing and the need for educators to be aware of diverse learning styles. During an FGD with beginner-level participants, several voiced similar concerns, emphasizing that the pace of instruction was too fast. "We needed more time to absorb the material, especially those of us new to ICT," said another participant, Laila (FGD, May 16, 2023). Such feedback reinforces the need for

more inclusive and flexible teaching strategies, where beginners receive the time and support they need to succeed without feeling rushed or left behind.

In addition to pacing issues, class size and noise levels were recurring problems. Large classes often created a noisy and distracting environment, which was particularly detrimental for participants with sensory disabilities. Mahmud, a visually impaired participant, stated, "It was too noisy, so it is hard to listen" (Mahmud, interview, February 11, 2023). Others echoed his concerns in an FGD session. Another visually impaired participant, Amir, commented, "The noise made it impossible to concentrate, and it felt like no one was paying attention to how disruptive it was for us" (FGD, May 16, 2023). The disruptive atmosphere hindered learning and led to frustration and anxiety for many participants. The consensus from the FGD was that smaller class sizes and better classroom management strategies would be necessary to create a more focused and inclusive learning environment. "Having fewer people in the class would make it easier for us to engage and for instructors to cater to everyone's needs," said Amir (FGD, May 16, 2023).

Participants also raised concerns about the availability of appropriate learning aids, particularly for those with disabilities. Mahmud's earlier comments on the lack of Braille materials are part of a broader issue of insufficient accessibility resources. "We need more than just verbal instructions; there should be tactile resources and better support for those with sensory impairments," said Siti, a visually impaired participant in the FGD (May 16, 2023). Participants suggested that including more adaptive technologies, such as screen readers, larger text formats, and real-time captioning for deaf participants, could bridge these gaps and make the learning experience more inclusive.

ICT training challenges highlight the need for adaptive instruction. Multi-tiered content, better pacing, smaller classes, and improved accessibility will enhance learning for all participants. Using feedback from interviews and FGDs can further refine the program to create a more inclusive and effective environment.

4.2. Theme 2: Building Confidence and Competence Through ICT Participation

4.2.1. Self-Confidence: Enhancing Belief in One's Abilities

The ICT skill training program had a transformative impact on participants' self-confidence, particularly those who entered the program with little to no technical experience. Many participants reported that the training equipped them with specific digital skills, such as visual editing using software like Adobe Photoshop, and enhanced their belief in their ability to apply them in personal and professional contexts. This shift in self-perception was crucial for many participants, as it empowered them to pursue opportunities they previously felt were out of reach.

For instance, Sisil's journey illustrates the program's profound influence on her self-confidence and personal growth. Before the training, Sisil had minimal experience with digital tools and felt uncertain about her success in the modern workforce. However, her confidence grew as she engaged in the hands-on learning activities. She shared, "To achieve success and gain new experiences" (Sisil, interview, February 2, 2023), suggesting that the training acted as a stepping stone toward her broader life goals. Sisil realized she could overcome challenges and pursue meaningful accomplishments by mastering new technical skills. During a FGD, Sisil elaborated on this sentiment, saying, "I never thought I could learn something so complex, but now I feel like

I can take on anything" (Sisil, FGD, May 15, 2023). For Sisil, the program was not just a technical course but a confidence-building journey that ignited her desire for continuous personal growth, including digital writing.

Similarly, Nanda's experience demonstrates how the program reshaped her perception of her capabilities. She entered the program with self-doubt but quickly gained confidence as she learned to navigate new digital tools. Nanda described feeling "enthusiastic, knowledgeable, and more confident" (Nanda, interview, March 14, 2023). Her experience underscores the importance of building self-assurance through skill development. In a follow-up interview, Nanda explained, "Before the training, I always felt like I was not smart enough to keep up with technology, but now I feel capable and ready to learn more" (Nanda, interview, April 2, 2023). This newfound confidence extended beyond the classroom, impacting her daily interactions and her willingness to explore additional personal and professional growth opportunities. Nanda's story highlights the broader psychological benefits of ICT training, providing her with the technical competencies and the confidence to pursue her aspirations.

Ahmad, another participant, also experienced a significant boost in self-confidence due to the training. He explained that taking the course allowed him to gain valuable knowledge, which he found essential for his growth and goals (Ahmad, interview, March 13, 2023). Ahmad's response reflects a recurring theme among participants: The training equipped them with foundational skills and sparked a curiosity for lifelong learning. During an FGD, Ahmad expanded on this, saying, "I never thought I would enjoy learning, but this program made me realize how much more I want to learn. It is just the beginning" (Ahmad, FGD, May 15, 2023). His eagerness to continue developing his skills underscores the importance of providing ongoing educational opportunities for PwD, as the initial confidence boost from the training can lead to sustained academic and professional growth. Ahmad's experience highlights how the program fostered a continuous improvement mindset, particularly for individuals who may have previously felt excluded from educational or professional development.

The training also opened up entrepreneurial ambitions for some participants, illustrating how newfound self-confidence could translate into broader professional goals. Michael, one such participant, shared his aspirations, stating, "I want to open a business" (Michael, interview, February 14, 2023). Michael's experience reflects how the training equipped him with technical skills and the belief that he could succeed as an entrepreneur. In an FGD session, he further elaborated, "Before the program, I did not think someone like me could run a business. But now, with these new skills, I feel like I can make it happen" (Michael, FGD, May 15, 2023). Michael's story is a testament to how ICT training can catalyze broader professional aspirations, particularly for PwD, who might have faced barriers in traditional employment settings. His experience illustrates the potential of such programs to empower participants to think beyond immediate skill acquisition and envision new possibilities for their future, such as pursuing higher education, starting a small business, or securing a remote job that aligns with their abilities. The program helped him achieve these aspirations by providing technical skills and fostering self-confidence, resilience, and the ability to navigate digital and physical environments independently. Additionally, the program's support in accessing assistive technologies and personalized mentorship was crucial in facilitating his journey toward economic and social empowerment.

The ICT training significantly increased participants' confidence, helping them realize their potential personally and professionally. By providing skills in a judgment-free environment, the program inspired ongoing growth.

Sisil, Nanda, Ahmad, and Michael's experiences show how practical training and support empower individuals to achieve their goals with newfound confidence.

4.2.2. Enhancing Resilience: Strengthening Confidence in Overcoming Difficulties

Beyond technical skill development, the ICT training program greatly enhanced participants' confidence in overcoming challenges in both personal and professional domains. Many found this increased problem-solving ability transformative, allowing them to approach previously daunting tasks with greater self-assurance in the digital space.

Revi's experience illustrates this shift, as she used the program to expand her social network via social media. She noted, "Through social media, I have become more confident in making new friends" (Revi, interview, February 16, 2023). Initially feeling isolated due to her disability, Revi found social media a vital tool for communication and connection. The training equipped her with technical skills and built her confidence to engage in online social interactions she had previously avoided. In a focus group, she added, "I used to be hesitant about reaching out online, but now I can communicate more effectively and confidently" (Revi, FGD, May 15, 2023). This transformation highlights how ICT training can enhance social confidence, opening new interaction and community-building possibilities.

Similarly, Anwar found that the program empowered him to seek employment opportunities online, a significant tool for PwD who face barriers in traditional job markets. "We learned about job vacancies for the disabled in Jakarta," he shared (Anwar, interview, March 7, 2023). Before the training, Anwar was still determined to navigate job portals, but afterwards, he could search for positions and apply independently. He elaborated during an FGD, "Before, I did not know where to start with job searching. Now, I can browse job sites, find disability-friendly positions, and apply confidently" (Anwar, FGD, May 15, 2023).

It is a testament to the personal growth and empowerment experienced by the participants in the ICT program. Anti, for instance, found the training transformative, particularly in enhancing her creative skills. She expressed, "I can now design an attractive magazine cover for schoolwork" (Anti, interview, April 9, 2023). This newfound ability in digital design has given her the confidence to express herself artistically. In a group discussion, she shared, "I used to struggle to keep up with more artistic students, but now I can create professional-looking designs. It is an incredible feeling" (Anti, FGD, May 15, 2023). Anti's journey is a shining example of how ICT training can unlock creative potential, instil confidence to explore new avenues of expression, and even consider career opportunities in graphic design or digital marketing.

Susan's experience clearly demonstrates the ICT program's role in fostering independence among its participants. She shared, "When something goes wrong with my computer, I no longer panic. I can fix simple issues on my own" (Susan, interview, April 6, 2023). This sentiment echoes a broader theme: The program equips participants with digital skills and boosts their confidence in troubleshooting. In a follow-up group discussion, Susan added, "Before, if my computer froze, I would immediately ask for help. Now, I try to fix it myself first, and most of the time, I succeed" (FGD, May 15, 2023). This newfound problem-solving ability has empowered participants to take ownership of their digital experiences and rely less on external help.

The ICT program gave participants the skills and confidence to handle challenges independently through social media, job applications, or creative problem-solving. Revi, Anwar, Anti, and Susan's stories illustrate how ICT training boosts self-efficacy, empowering them to embrace opportunities and confidently overcome obstacles.

4.3. Theme 3: Empowering PwD Through Coordinated Support and Autonomy

4.3.1. Community and Family Support

Community support has proven vital in advancing ICT skills among PwD. These networks offer practical training, foster a deep sense of belonging, and provide motivation. The Association of the Visually Impaired in Palembang exemplifies how peer collaboration can empower members to embrace new technologies. Dewa, the Association of the Visually Impaired's secretary, emphasized how shared knowledge boosts ICT capabilities: "A collective drive to share ICT skills and explore new applications" (Dewa, interview, March 11, 2023). During a focus group, other members echoed how AVI's culture of mutual support reduced feelings of isolation in their learning journey: "We help each other with technical challenges and motivate one another during moments of frustration" (FGD, May 16, 2023). This blend of technical support and emotional encouragement was crucial for building confidence and independence.

In academic settings, teachers also play a pivotal role in enhancing students' ICT proficiency and confidence in entering the workforce. Wijaya, a teacher at State Special School—SSS Balikpapan, noted the long-term benefits of ICT education for students with disabilities: "ICT competence instill confidence, preparing students for professional environments" (Wijaya, interview, February 11, 2023). SSS Balikpapan collaborates with local businesses to provide real-world experience, bridging classroom learning with workplace expectations. One program alum, now employed at a local hotel, reflected: "Learning ICT and applying it in the hotel gave me confidence that I could perform as well as anyone else" (Interview, April 25, 2023). Such partnerships demonstrate the importance of applying ICT skills in practical contexts to build competence and self-assurance.

Beyond formal education, teachers like Santi offer additional support to ensure students master ICT skills. Santi explained how she provided extra assistance outside regular class hours: "Teachers must dedicate extra time to help students beyond normal learning hours" (Santi, interview, March 17, 2023). In a focus group, one student shared how this personalized attention significantly impacted: "Without Santi's extra help, I would not have understood the program we were learning. She ensured I did not fall behind" (FGD, May 16, 2023). Santi's commitment underscores the importance of tailored support, accommodating different learning paces, and ensuring all students succeed in ICT mastery.

Parents also play a crucial role in fostering ICT education for their children with disabilities. Dita, a participant from Manado, shared how her parents' support was crucial to her development: "Parents' encouragement gave me confidence, helping me see that I could be on par with non-disabled peers" (Dita, FGD, May 16, 2023). By providing access to ICT tools at home and reinforcing the importance of practice, Dita's parents helped sustain her learning. She noted, "Even when I did not feel like practising, my parents reminded me of how important these skills are for my future" (FGD, May 16, 2023). This constant support from her family, as highlighted by Dita's experience, is instrumental in helping PwD gain the confidence and skills needed for greater independence.

Similarly, Zaky, from West Papua, expressed gratitude for the holistic support his parents provided during his ICT education: "My parents built my confidence and encouraged me to engage with my peers and community" (Zaky, interview, February 19, 2023). In a later interview, Zaky shared how this combination of technical learning and social inclusion empowered him to participate in community activities: "Before, I hesitated to join in, but with my ICT skills, I felt I had something to contribute" (interview, March 5, 2023). His experience highlights how family support extends beyond academics, fostering social confidence and inclusion.

Dewa, Dita, and Zaky's stories emphasize how Community and family support empower PwD. Mentorship, teacher guidance, and family encouragement helped participants gain skills and emotional strength to apply them, fostering independence, professional growth, and social inclusion.

4.3.2. Internal and External Factors Shaping the Independence of PwD

Both internal and external factors shape PwD's journey to independence. Personal qualities like resilience and self-motivation are essential, while external supports—such as role models, accessible technology, and mentorship—play a complementary role. This section explores how these elements combine to foster technical and emotional empowerment. Resilience is critical, as PwD often face ongoing obstacles requiring determination. As Lisa from an FGD noted, "Our internal strength drives us forward. Without self-belief, external support alone is insufficient" (Lisa, FGD, May 16, 2023), underscoring the importance of self-motivation in overcoming barriers and maximizing external support. This resilience and self-motivation of PwD should inspire us all in the face of challenges. For many, self-motivation is the key to achieving goals. Rizky, a participant from East Kalimantan, shared how small victories during ICT training fueled his motivation: "I started with simple tasks like sending an email, then moved to design a flyer. Each success built my confidence, allowing me to tackle more complex tasks" (Rizky, interview, March 12, 2023). His experience illustrates how small accomplishments reinforce self-motivation, creating a positive cycle of personal growth.

Role models are essential in demonstrating that independence is possible despite challenges. Lisa emphasized the value of witnessing success within the disability community: "Role models are crucial. Seeing disabled people achieve financial independence inspires others to push boundaries" (Lisa, FGD, May 16, 2023). Success stories shift disability perceptions from limitations to potential. Another participant shared how seeing a visually impaired person succeed in a corporate job inspired him to aim higher: "I did not think those roles were for us, but seeing someone like me succeed made me believe I could too" (Dewa, interview, March 25, 2023). Role models thus reshape societal views and help challenge internalized limitations.

Technology has become a critical tool for PwD, levelling the field in professional and social spaces. Silvia, a visually impaired civil servant, shared how mastering ICT transformed her work: "Technology made me more effective, boosting my confidence" (Silvia, FGD, May 16, 2023). Tools like screen readers and voice-to-text software empower PwD by breaking barriers. Rudy, a deaf community leader, emphasized the importance of communication tools, noting the challenges students face when sign language support is lacking in schools, leading to passivity (FGD, May 16, 2023).

Mentorship is vital for PwD independence. Basuki, a physically disabled participant, highlighted its value: "Mentors guide us and make sure we do not feel alone" (FGD, May 20, 2023). He shared how mentorship

helped him confidently use his wheelchair in public: "I was afraid to leave the house, but my mentor showed me how to navigate safely" (interview, April 15, 2023). Mentorship promotes skills, resilience, and expanded social networks, fostering personal and professional growth. The journey toward independence for PwD is multifaceted, blending internal resilience with external support.

Role models inspire, technology empowers, and mentors provide guidance. When coupled with self-motivation, these factors create a robust framework for empowerment, enabling PwD to overcome obstacles and pursue their personal and professional aspirations. This integrated approach underscores the complexity yet attainability of independence for PwD.

5. Discussions

5.1. Empowering PwD Through ICT Skill Enhancement

The results of this study reinforce the transformative power of ICT in enhancing the lives of PwD. Supported by empowerment theory, ICT programs offer technical skills and facilitate a broader social empowerment process. As Zimmerman (1995) and Perkins and Zimmerman (1995) explain, empowerment allows individuals to control resources and make decisions, fostering autonomy and self-efficacy. This study found that ICT training empowered participants to transcend societal barriers, enhancing their social inclusion and participation. The transformative impact of these programs highlights their importance and the need for sustained efforts to implement them across various contexts.

The literature further supports this, demonstrating how ICTs can open educational and employment opportunities for PwD across regions. For instance, ICT training in Bangladesh has significantly improved the social and economic freedoms of people with visual impairments, enabling them to access education and employment (Hasan et al., 2018). These findings suggest that ICT equips individuals with practical skills and empowers them to challenge systemic barriers and navigate their environments independently.

One notable outcome of this study was the marked improvement in participants' self-confidence and independence after ICT training. It aligns with Rappaport's (1987) assertion that empowerment occurs when individuals gain control over their environments, allowing them to make informed decisions. Equipped with digital skills, participants could independently perform online communication and job searching tasks previously obstructed by systemic limitations. Similarly, ICTs have been shown to reduce social isolation in PwD by fostering engagement in broader social networks (Zimmerman, 1995), as evidenced in Qatar's assessment of e-readiness, which revealed the need for inclusive digital environments to better support the skill development of PwD (Othman et al., 2023).

Furthermore, the access to employment opportunities facilitated by digital literacy was a significant finding. As observed in this study, the ability to navigate the job market effectively mirrors Alsop et al. (2006), who argue that empowerment includes economic agency through skill acquisition. Similar observations have been made in China, where ICT employment opportunities in e-commerce and software development have opened new avenues for PwD, although often without legal protections (Qu, 2020). Despite the successes, the study revealed challenges due to participants' varied ICT skill levels, echoing Narayan's (2005) view that empowerment is an ongoing, individualized process that requires sustained support. This analysis strongly

affirms that ICT programs go beyond technical intervention—they are crucial to fostering empowerment in PwD by enabling them to achieve independence, social inclusion, and economic participation.

5.2. Policy and Practical Implications

One of the key findings of this study is the pressing need for increased funding and resources to make ICT training more accessible to PwD. Participants faced several logistical challenges, including the lack of assistive technologies like Braille displays and hearing aids. These gaps are similarly noted in global literature, where inadequate resources and infrastructure severely limit the effectiveness of ICT programs for PwD (Notoprayitno & Jalil, 2019). Governments and policymakers must prioritize investment in assistive technologies to realize the full potential of ICT programs. It is important to note that such investment not only enhances the quality of life for PwD but also contributes to the economy by enabling their participation in the workforce. In rural or low-resource areas, especially in Asia and the Middle East, collaboration between governments, private organizations, and NGOs could bridge the resource gap (Avanesyan, 2020). For example, the ICT infrastructure in Bangladesh and Qatar showcases both the potential and the need for comprehensive resource allocation to achieve equitable ICT training for PwD (Hasan et al., 2018; Othman et al., 2023).

Another policy implication is ensuring that training materials are accessible to individuals with varying learning needs. As observed in this study, the absence of accessible formats such as Braille or sign language interpretation limits inclusivity in ICT programs. Kerras et al. (2022) argue that inclusivity in digital platforms is essential for fostering equal access to ICT training. Ensuring that training materials are available in diverse formats could significantly improve participants' learning experiences. In addition to accessible materials, physical infrastructure—such as adequately designed classrooms and quiet learning environments—also plays a crucial role in accommodating participants with disabilities (Chadwick, Buell, et al., 2023).

A third critical implication is the need to evaluate and adapt ICT training programs continuously. The study revealed that while some participants found the training too elementary, others struggled due to a lack of foundational ICT skills. This underscores the need for adaptive learning technologies that tailor content to individual learning needs, as Safari et al. (2023) highlighted. Modular learning systems, where participants can focus on specific topics based on their existing skills, would enhance personalization and maximize the effectiveness of ICT training. Additionally, program evaluations should incorporate feedback from participants with disabilities to ensure the training content remains relevant and accessible (Weber et al., 2022).

These findings have broad implications, particularly for countries in Asia and the Middle East facing similar systemic challenges in providing ICT training for PwD. Addressing these gaps through better infrastructure, accessible materials, and adaptive learning platforms is essential to empowering PwD across diverse contexts.

6. Conclusion

This study underscores the transformative role of ICTs in empowering PwD. Grounded in empowerment theory, the findings demonstrate that ICT skill development programs are not mere technical interventions but act as transformative tools. They enable PwD to gain greater autonomy, self-efficacy, and participation in social and economic spheres. Participants reported increased self-confidence and independence,

illustrating the potential of ICTs to dismantle societal barriers and reduce social isolation, reinforcing Zimmerman's (1995) perspective on empowerment as a multifaceted process involving control over one's environment.

The research also underscores critical challenges that must be addressed to optimize the efficacy of ICT programs, particularly the need for accessible learning materials, adaptive educational approaches, and improved infrastructure. Disparities in participants' ICT competencies suggest that more than a one-size-fits-all approach is required. Tailored, modular learning platforms and sustained policy support are necessary to ensure inclusivity and effectiveness for individuals with varying skill levels. These findings align with global literature, which advocates for aligning policies, infrastructure, and resources to create equitable access to ICT for PwD, especially in resource-limited settings such as rural areas in Asia and the Middle East.

Finally, the study emphasizes that the success of ICT initiatives depends on the availability of technology and the comprehensive integration of supportive policies, adequate funding, and inclusive infrastructure. It underscores the need for governments, private sector stakeholders, and international organizations to collaborate in addressing these gaps. This collective action is crucial in ensuring that ICT serves as a vehicle for empowerment and socioeconomic participation for PwD. The findings provide a roadmap for future research and policy development, advocating for a holistic, inclusive approach to ICT skill development that maximizes the potential of PwD across diverse contexts.

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Conflict of Interests

The authors declare no conflict of interest.

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ARTICLE

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The Effectiveness of an Educational Intervention on Countering Disinformation Moderated by Intellectual Humility

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Abstract

There is an ongoing debate among scholars on how to tackle disinformation. Media education initiatives to increase literacy are effective ways to counter disinformation. Hence, the European Commission (2022) published *Guidelines for Teachers and Educators on Tackling Disinformation and Promoting Digital Literacy Through Education and Training*. The present research looked at the role of social media literacy in increasing awareness of the role of social media in spreading disinformation. We developed an educational intervention based on the European Commission guidelines. We investigated its impact on perceived social media literacy, the intention to share fake news on social media, and general conspiracy beliefs. We conducted a within-subject (two times measurement: before the educational intervention and one week after) +1 experiment with $N = 127$ young adults (aged 18 to 23). After filling in an initial survey, the experimental group received a 15-minute educational intervention on the role of social media for disinformation dissemination in complex digital information environments. One week later, all participants completed the second survey to assess perceived social media literacy and general conspiracy beliefs. In both surveys, participants saw three Instagram posts from a fictitious media outlet to express potential intentions to share on social media. Among the three posts, two showed false information. Findings showed that educational intervention produces a significant increase in perceived social media literacy and a decrease in general conspiracy beliefs. Intellectual humility moderates the impact of educational intervention on algorithmic awareness.

Keywords

conspiracies; conspiracies belief; digital literacy; Instagram; intellectual humility; social media; social media literacy

1. Introduction

In the complex digital information environments, disinformation is increasingly seen as a significant threat to democratic systems (Bennett et al., 2018). The rapid dissemination of false or misleading information through social media platforms and other digital channels has profound implications for the integrity of democratic processes and institutions (Allcott et al., 2018; Chirwa & Manyana, 2021; Watts et al., 2021). Disinformation campaigns exploit vulnerabilities in social media platforms, leading to epistemic cynicism, polarization, and pervasive inauthenticity (Pérez-Escolar et al., 2023). Exposure to disinformation can prime support for extremist positions and delegitimize democratic values, regardless of the source's authenticity (Hameleers et al., 2022). These effects undermine fact-based and respectful communication, essential for deliberative democracy (McKay & Tenove, 2020). The disruption of the public's ability to engage in informed and rational debate is a core threat posed by disinformation (Tenove, 2020).

Strategies to fight disinformation that were effective with certain limitations include fact-checking and debunking (Arcos et al., 2022; Chan et al., 2017), inoculation (Lewandowsky & Linden, 2021; Vivion et al., 2022), and forewarning, which aim to expose and disprove misleading content (Arcos et al., 2022). Given the constantly evolving social media landscape, previous studies highlighted the role of educational actions in countering the disinformation phenomenon (Nygren et al., 2022; Nygren & Guath, 2022). The European Commission (2018) developed an action plan to fight disinformation and stressed how crucial citizen education is and, in 2022, the European Commission (2022) published *Guidelines for Teachers and Educators on Tackling Disinformation and Promoting Digital Literacy Through Education and Training*. However, media education should be more comprehensive, beyond children and adolescents, and integrated into lifelong learning strategies for young adults.

Previous research stressed the role of social media in enhancing the disinformation phenomenon (Chirwa & Manyana, 2021; Corbu et al., 2020). Thus, the production and distribution of fake news and conspiracy theories are facilitated by platform affordances (Jain, 2023). Therefore, an educational intervention can raise awareness of the negative role of social media in spreading disinformation. Prior research delved into the role of digital media literacy in combating disinformation (Nygren et al., 2022; Nygren & Guath, 2022). However, a more nuanced understanding of the role of social media literacy is needed. Besides the role of intellectual humility (Leary et al., 2017), a concept related to critical thinking for the impact of educational intervention required additional attention from scholars. Disinformation poses a growing threat to democratic processes, and media literacy has emerged as a critical tool in combating this phenomenon, with media literacy initiatives designed to equip individuals with the skills to critically evaluate and interpret media content having gained prominence recently. Dame Adjin-Tettey (2022) demonstrates that media literacy education can effectively combat fake news, disinformation, and misinformation through experimental evidence. This aligns with broader trends observed across the European Union, where media literacy is increasingly integrated into educational policies and frameworks to address the disinformation crisis (Sádaba & Salaverría, 2023). Despite these advances, challenges remain in implementing these initiatives universally and effectively, particularly in rapidly evolving digital landscapes.

The present research looked at the impact of educational intervention on young adults (18 to 23 years) to enhance social media literacy, the intention to share on social media, and general conspiracy beliefs. Previous research on disinformation mainly focused on social media platforms such as X, formerly known as

Twitter (e.g., Dasilva et al., 2021; Keller et al., 2019; Linvill & Warren, 2020), and Facebook (e.g., Iosifidis & Nicoli, 2020; Jang et al., 2019). Even though Instagram is a popular platform among young adults (Shane-Simpson et al., 2018), investigating news sharing on this platform within the context of disinformation needs additional attention. Therefore, the present research investigates news sharing on Instagram. We developed an educational intervention based on the European Commission (2022) guidelines that we adapted for young adults and investigated its impact on social media literacy. Furthermore, we tested the moderating effect of intellectual humility (Leary et al., 2017) on the effectiveness of the educational intervention on algorithmic awareness, a crucial dimension of social media literacy.

2. Theoretical Framework

2.1. Empowering Critical Thinking Through Media Literacy

Media literacy is increasingly recognized as a critical skill in the digital age, where the proliferation of digital media and the prevalence of misinformation necessitates the ability to evaluate and interpret media messages critically. This skill is essential for informed citizenship, lifelong learning, and effective participation in a digitally connected society. Media literacy promotes critical thinking skills, enabling individuals to evaluate and choose information sources, interpret news, and make independent choices (Escoda et al., 2017; Mrisho & Dominic, 2023). It is essential for navigating the digital landscape, where misinformation and fake news are prevalent (Manzoor, 2018). Incorporating media literacy into educational curricula is crucial for developing skills in the digital age as media literacy education provides a framework for new literacy needed for living, working, and citizenship in the 21st century (Dolanbay, 2022). It helps individuals become conscious media consumers and producers, understanding the reality of media (Koltay, 2011). Developing critical approaches to digital media is a prerequisite for using them as learning resources (Burnett & Merchant, 2019; Dezuanni, 2015).

Media literacy is a multifaceted concept that can be defined and approached in various ways. For this research, we define media literacy following Potter's (2019) cognition-based approach, which focuses on understanding and processing media content through critical analysis. Potter's definition emphasizes the cognitive skills necessary for comprehending and evaluating media messages, a foundational aspect of media literacy. However, it is essential to acknowledge that media literacy is not limited to cognitive processes; it also involves affective components, such as emotional responses and attitudes toward media content (Pennycook & Rand, 2019). These aspects are particularly relevant for social media literacy, encompassing technical competency, social interactions, and awareness of disinformation and algorithmic processes (Tandoc et al., 2021). According to the European Commission, media literacy is "the ability to access the media, to understand and critically evaluate different aspects of the media and media contexts, and to create communications in a variety of contexts" (European Commission, 2022, p. 12).

Kellner and Share (2019) frame media literacy within the context of empowerment and critical citizenship, arguing that it should enable individuals to navigate the media landscape with a critical eye, discerning between credible information and misinformation, thereby fostering an informed and engaged populace capable of participating in democratic processes (Kellner & Share, 2019). Digital literacy is increasingly recognized as a cornerstone of effective participation in the modern digital information landscape. Given the inclusion of intellectual humility—a trait that involves recognizing the limits of one's knowledge and being open to revising beliefs—the theorization of media literacy in this study must incorporate cognitive and

affective dimensions. Intellectual humility aligns with the affective aspects of media literacy by promoting openness to new information and the willingness to change one's mind in light of new evidence (Leary et al., 2017). Thus, our conceptualization of social media literacy includes the cognitive ability to process information and the attitudinal and behavioral aspects that influence media consumption and interaction in digital environments.

According to Belshaw (2016), digital media literacy transcends basic technical skills, encompassing a broader set of competencies such as critical thinking, ethical considerations, and the ability to engage with digital content critically. Belshaw emphasizes that digital literacy is essential for navigating the complexities of the digital world, from discerning the reliability of online sources to engaging in productive online discourse (Belshaw, 2016). Ng (2015) discusses the integral role of digital literacy in professional and personal development, pointing out that in a world where digital technologies pervade every aspect of life, from workplace productivity tools to social media, digital literacy skills are vital for effective communication, problem-solving, and lifelong learning. This perspective illustrates the wide-ranging applicability of digital media literacy, making it indispensable in contemporary society (Ng, 2015). Media literacy is thus a vital skill in the digital age, essential for critical thinking, informed decision-making, and effective participation in a digitally connected society. Integrating media literacy into education is crucial for developing digital skills and fostering lifelong learning. By promoting critical approaches to media and acknowledging its sociocultural impacts, media literacy empowers individuals to navigate the complexities of the digital world responsibly and effectively. The importance of digital literacy in today's information-rich environment cannot be overstated, as digital technologies evolve, fostering digital literacy becomes ever more critical for empowering individuals to engage with and navigate the digital society effectively.

Previous studies stressed that media literacy education significantly enhances students' critical thinking abilities, enabling them to understand better and critique media content (Feuerstein, 2010; Zou'bi, 2021). Programs incorporating media literacy into the curriculum positively affect students' ability to critically analyze media messages and develop a skeptical approach to media consumption (Ku et al., 2019; Zou'bi, 2021). Collaborative efforts among educators, administrators, and parents are essential for successful media literacy programs (Brown, 1998) as adolescents who frequently consume news on social media and possess higher news media literacy are better at applying critical thinking to real-life news reports (Ku et al., 2019). Similar results might also be achieved through media education for early-stage adults, given that scholars pointed out that in social media, literacy-related critical performances develop during young adulthood (Zarouali et al., 2020).

Media literacy is about knowledge and the translation of that knowledge into critical actions and behaviors, essential for fostering a culture of critical thinking and embracing cultural diversity (Riesmeyer et al., 2019). Furthermore, critical thinking facilitates the deconstruction of media messages, enabling individuals to understand underlying motives, biases, and potential impacts (Pennycook & Rand, 2019). This analytical approach is vital in an era where media messages are designed to subtly influence public opinion and behavior. Pennycook and Rand's (2019) experimental studies highlight that individuals who engaged in critical reflection were less likely to be swayed by fake news, demonstrating the protective role of critical thinking in media consumption.

In examining the effectiveness of the educational intervention, it is crucial to distinguish between social media literacy as a skill set and social media literacy efficacy, which refers to an individual's confidence in their ability to use those skills effectively. Bandura's (1977) self-efficacy theory, which posits that an individual's belief in their ability to achieve specific outcomes is crucial for motivation and behavior, has been extensively applied across various domains, including health, education, and media literacy. This synthesis examines the intersection of Bandura's self-efficacy principles with media literacy, particularly emphasizing the impact of self-efficacy on media consumption and literacy practices. In media literacy, self-efficacy is critical in how individuals navigate the increasingly complex media landscape.

The concept known as "news efficacy," derived from Bandura's (1977) theory, illustrates how self-efficacy influences individuals' engagement with news media. Park (2019) demonstrates that news efficacy mediates the relationship between perceived news overload on social media and news avoidance, specifically, when individuals experience high news overload, their news efficacy decreases, leading to more significant news avoidance. Moreover, news efficacy also mediates the positive relationship between perceived news overload and social filtering, suggesting that individuals with higher levels of news efficacy are better equipped to filter and manage relevant news content despite the overwhelming volume of information available (Park, 2019). Despite its widespread application, self-efficacy theory faces ongoing theoretical and methodological challenges, particularly in its definition and assessment. Marzillier and Eastman (1984) argue that self-efficacy can only be fully understood by considering outcome expectations, raising concerns about the theory's comprehensiveness.

Additionally, the practical value of self-efficacy theory requires further empirical validation to demonstrate its effectiveness across different contexts (Marzillier & Eastman, 1984). The influence of self-efficacy extends into literacy education, significantly impacting students' reading abilities and performance. Ortlieb and Schatz (2020) emphasize that self-efficacy is crucial for literacy learning, as students' confidence in their reading abilities is closely linked to their actual performance, and, therefore, effective literacy instruction should incorporate self-efficacy principles to foster students' confidence and enhance their reading skills (Ortlieb & Schatz, 2020).

Social media literacy, which includes understanding the implications of digital platforms, is crucial for developing critical thinking and socio-emotional competencies (Polanco-Levicán & Salvo-Garrido, 2022). Social media literacy is a form of media literacy that reflects specific knowledge, attitudes, and behavior towards social media. Tandoc et al. (2021) highlighted four dimensions of social media literacy: technical competency; social relationship and interaction; awareness of the informational landscape, including disinformation awareness; and privacy and algorithmic awareness. Social media literacy can contribute to a comprehensive understanding of complex information environments (Polanco-Levicán & Salvo-Garrido, 2022) and, like media and digital literacy (Escoda et al., 2017), social media literacy can be improved with the help of education. Moreover, effective education can reduce disinformation dissemination (Nygren et al., 2022; Nygren & Guath, 2022).

Considering the relevance of social media for young adults, investigating social media literacy as a self-perceived participatory moral literacy is crucial (Wendt et al., 2023). Young adults aged 18–23 are particularly responsive to social media literacy interventions due to their brain development and social changes. Hence, the prefrontal cortex maturation, which takes place until the mid-20s, is responsible for

executive functions such as decision-making, impulse control, and critical thinking. During this period, young adults actively explore and solidify their identities, including their social, political, and cultural beliefs (Arnett & Mitra, 2020), with social media playing a significant role in this process by providing a platform for self-expression and exposure to diverse viewpoints (Arnett et al., 2020). Therefore, a literacy intervention can help them navigate this landscape critically, ensuring that their identities are shaped by reliable information rather than disinformation. Consequently, we hypothesized:

H1: The educational intervention improves perceived social media literacy (PSML).

H2: The educational intervention reduces the intention to share fake news on social media.

2.2. Reducing Conspiracy Beliefs Through Media Literacy

Conspiracy narratives represent a significant challenge to media literacy, as they endorse unfounded and often implausible explanations for events, leading to widespread misinformation and societal distrust. Media literacy, the ability to critically assess and interpret media content, is crucial in combating the influence of conspiracy theories (Lewandowsky et al., 2013), with research indicating that individuals with low media literacy are more susceptible to conspiracy theories (Pasek et al., 2015). This susceptibility arises from a need for more critical thinking skills to evaluate the credibility of sources and the validity of information. For instance, a study by Pennycook and Rand (2019) found that participants with higher levels of analytical thinking were less likely to believe in conspiracy theories. Educational interventions addressing critical thinking and intellectual humility can reduce conspiracy theory beliefs. Furthermore, algorithmic awareness is crucial in empowering social media users to evaluate the information they encounter critically and it can reduce the spread of disinformation. Therefore, we posited:

H3: The educational intervention significantly reduces general conspiracy beliefs.

H4: The educational intervention increases algorithmic awareness.

H5: The algorithmic awareness reduces (a) the intention to share fake news on social media and (b) conspiracy beliefs.

2.3. Intellectual Humility and the Relationship to Social Media Literacy

Intellectual humility, defined as recognizing the limits of one's knowledge and openness to new information, plays a complementary role in media literacy (Krumrei-Mancuso & Rouse, 2016). In the context of media consumption, intellectual humility involves acknowledging that one's initial beliefs may be incorrect and being open to revising them in light of new evidence (Leary et al., 2017). The synergy between critical thinking and intellectual humility creates a robust framework for media literacy: Critical thinking provides the analytical tools necessary to scrutinize information, while intellectual humility ensures openness to new evidence and perspectives (Krumrei-Mancuso et al., 2020). Together, these traits foster a balanced approach to media consumption that mitigates the risks of misinformation and cognitive biases. Krumrei-Mancuso et al. (2020) conducted a longitudinal study on college students, demonstrating that interventions designed to enhance critical thinking and intellectual humility improved media literacy outcomes. Individuals high in

intellectual humility are less likely to adhere rigidly to conspiracy theories when presented with credible, contradictory evidence (Bowes et al., 2020). The study revealed that participants who developed these skills were more adept at identifying misinformation and less susceptible to confirmation bias.

Moreover, integrating these cognitive traits supports lifelong learning and adaptability, essential qualities in an ever-evolving media landscape (Sinatra et al., 2016). Intellectual humility encourages continuous learning and the acceptance of uncertainty, while critical thinking equips individuals with the skills to evaluate new information critically. Thus, we asked the following research question:

> RQ1: Does intellectual humility play a moderating role between the educational intervention and PSML?

3. Method

3.1. Experimental Design and Procedure

To investigate the educational intervention's impact on enhancing social media literacy and reducing intentions to share fake news on social media and conspiracy beliefs, we conducted a within-subject (two-time measurement: before the social media literacy intervention and one week after) +1 experiment with $N = 127$ young adults, aged 18 to 23 ($M = 19.7$, $SD = .88$).

Developing a 15-minute educational intervention for adults aged 18 to 23 years on social media and disinformation offers several benefits, both for the target audience and the effectiveness of the intervention. First, this age group is among the most active on social media, making it crucial to understand how disinformation spreads. The intervention aimed to improve users' ability to critically evaluate social media, as this can foster informed and responsible digital behavior. Empowering young adults can lead to more confident and assertive engagement with social media (Wendt et al., 2023), reducing susceptibility to manipulation and, by educating this age group, which frequently shares content online, the intervention can help reduce the spread of disinformation. Furthermore, the intervention aims to contribute to developing broader critical thinking skills.

Second, a 15-minute format allows for a focused content delivery, conveying the key points clearly: This brevity helps maintain attention and engagement (Yeager & Walton, 2011), which is crucial given the short attention spans often associated with this age group. A 15-minute educational intervention for adults aged 18–23 is an effective way to quickly and efficiently equip this key demographic with the skills needed to navigate the complexities of social media and disinformation while being accessible, memorable, and easily scalable.

After the informed consent, all participants completed a survey using a Qualtrics link to measure our dependent variables, social media literacy and conspiracy beliefs, and potential confounding variables. All participants were instructed to view three Instagram posts as usual Instagram users do. We chose a fictitious media outlet to avoid preexisting attitudes towards an existing media outlet, with two posts showing fake news and one presenting accurate information. However, we did not mention the facticity of the news.

After filling in the survey, the experimental group (n_1 = 82) received a 15-minute presentation about disinformation in digital environments and the role of social media in disinformation spreading. The intervention was based on the European Commission's (2022) published *Guidelines for Teachers and Educators on Tackling Disinformation and Promoting Digital Literacy Through Education and Training*. However, given that the European Commission guidelines were aimed at education in schools, following the primary information from the guidelines, the intervention was adapted for the young adult age group. The description of the intervention is available online in the supplementary materials. The control group (n_2 = 45) attended a 15-minute presentation on a topic non-related to the subject of the investigation.

One week later, all participants completed the second survey, using the Qualtrics platform to self-assess social media literacy and general conspiracy beliefs. We applied the survey not immediately after the first intervention to avoid potential bias while filling in the questionnaire assessing the same variable. Furthermore, the participants also saw three Instagram posts from the same fictitious media outlet, as shown in the first survey, and expressed intentions to share each Instagram post on social media. In this case, two out of the three posts also presented fake news related to different topics such as the economy, alimentation, and healthcare. Examples of Instagram posts containing news are shown in the supplementary materials.

A debriefing was included at the end of both surveys, pointing out the posts that presented fake news. The study was conducted after receiving the approval of the reviewer board of the Doctoral School of Communication, Public Relations, and Advertising of the Babeș-Bolyai University.

3.2. Stimulus Materials and Participants

The educational intervention was delivered as a short lecture presented by an experienced faculty member. First, students were introduced to concepts such as disinformation, misinformation, and the types of fake news (Tandoc et al., 2018). The presentation's topic of disinformation and the impact of sharing fake news on social media was central, and how social media algorithms influence information spreading was also highlighted.

Participants (86% female) were 88% undergraduate, and the rest were graduate students at a large European university that used Instagram (53% more than one hour daily). The popularity of Instagram among female users highlights the platform's role in shaping self-perception and social interaction (Shane-Simpson et al., 2018). We recruited the participants by posting an advertisement in the university and they were then randomly assigned to one of the two conditions. Participation was voluntary, and they received credits in exchange. The initial number of participants who filled out the first survey was 160; however, 140 participants filled in the second survey.

Furthermore, after eliminating uncompleted answers and participants with no Instagram account, the final number of participants was downsized to 127. A priori power analysis with G*power 3.1 was conducted to determine the minimum sample size for our experimental design. We considered two groups and two measurements for the alpha error probability set to α = .05, power = .95, and the minimum sample size needed is N = 106. Hence, with N = 127 participants, our final sample aligned with the requirements.

3.3. Measures

PSML was measured using 14 questions assessing four dimensions. Technical competency was measured using five questions (e.g., "I know how to remove unwanted content from my social media account"), social relationship with three questions (e.g., "I know how to handle conflicts on social media appropriately"), informational awareness with three questions (e.g., "I can tell whether information on social media is true or false"), and algorithmic awareness also with three questions (e.g., "social media platforms such as Instagram control what I see on social media"). Responses were given on a 5-point Likert scale from 1 *totally disagree* to 5 *totally agree* (Tandoc et al., 2021).

"Intention to share the news" was measured for each of the news presented in the three Instagram posts in the first survey and in the second one with the question: "How likely would you be to share this news on social media (e.g., via Instagram posts, direct messages or other social media platforms)?" Responses were given on a 5-point Likert scale from 1 *extremely unlikely* to 5 *extremely likely*. We only considered the responses to fake news (two items for the first survey and three for the second study).

General conspiracy beliefs were measured with 12 statements, such as the belief in undisclosed important events, politicians not revealing true motives, government agencies closely monitoring citizens, seemingly unrelated events being the result of secret activities, and the influence of secret organizations on political decisions (e.g., "I think there are a lot of very important things going on in the world that the public is never informed about"). Responses were given on a 5-point Likert scale from 1 *totally disagree* to 5 *totally agree* (Brotherton et al., 2013).

Intellectual humility was measured with six statements (e.g., "in the face of contradictory evidence, I am open to changing my opinion") and responses were given on a 5-point Likert scale from 1 *totally disagree* to 5 *totally agree* (Leary et al., 2017).

Instagram usage was measured with a single question (1 = "less than 10 minutes daily" to 6 = "more than three hours daily,"; $M = 4.5$, $SD = 1.24$). "Instagram attachment" was measured using six items (e.g., "I would be sorry if Instagram closed"). Responses were given on a 5-point Likert scale from 1 *totally disagree* to 5 *totally agree* ($\alpha = .79$, $M = 3.79$, $SD = .76$; Alhabash & Ma, 2017); frequency of news consumption was measured with a single question on a 6-point Likert scale (e.g., "how often do you normally access the news? By news, we mean international, national, or regional/local news accessed through any platform [e.g., newspapers, radio, TV, online, social media]") from 1 *not at all* to 6 *more than then times daily* ($M = 3.61$, $SD = 1.18$). Survey items are presented in the supplementary materials.

4. Findings

4.1. Randomization Checks and Descriptive Statistics

Randomization checks for age ($t\ (126) = 7.67$, $p = .06$), gender ($\chi^2(1) = .28$, $p = .59$, $\phi = .05$), Instagram usage ($t\ (126) = 1.27$, $p = .89$), Instagram attachment ($t\ (126) = .64$, $p = .72$), and interest in the news ($t\ (126) = -.54$, $p = .53$) showed no significant differences between the two conditions (with and without educational intervention).

The participants' self-assessed social media literacy scores were also high before the intervention, with reported high scores in intellectual humility. Table 1 shows means and *SD* per condition for mediator and dependent variables.

Table 1. Descriptive analysis and reliability analysis.

	Before the educational intervention		After the educational intervention	
	M (*SD*)	α	*M* (*SD*)	α
PSML	4.28 (.43)	.82	4.36 (.38)	.71
Technical competency	4.85 (.49)	.91	4.89 (.41)	.79
Social relationship	3.61 (.81)	.78	3.79 (.73)	.73
Informational awareness	4.03 (.67)	.79	4.09 (.63)	.80
Algorithmic awareness	4.24 (.67)	.65	4.33 (.64)	.61
General conspiracy beliefs	2.89 (1.03)	.91	2.14 (.95)	.94
Intention to share the news	2.19 (1.11)	—	1.76 (.98)	—
Intellectual humility	4.19 (.50)	.71	—	—

Note: $N = 127$.

Except for the PSML measured before and after the intervention and intellectual humility measured only before the intervention, there are no significant correlations between variables. Table 2 shows bivariate correlations between variables measured before and after the intervention.

Table 2. Bivariate correlations.

Variable	1	2	3	4
PSML	1	−.054	.004	.32**
General conspiracy beliefs	−.003	1	.166	.030
Intention to share the news	−.055	.145	1	.115
Intellectual humility	.351**	.044	−.089	1

Notes: $N = 127$; ** correlation is significant at the .01 level (two-tailed); Pearson correlations below the diagonal are for the variables measured before the intervention; Pearson correlations above are for those measured after the intervention; intellectual humility was measured only before the intervention.

4.2. Hypotheses Testing

We posited that the educational intervention improves PSML (H1). The paired-sample t-tests for PSML for the non-intervention ($t\ (44) = -.85$, $p = .40$) and the intervention group ($t\ (81) = -3.03$, $p = .003$) showed that the intervention had a significant positive effect on PSML. Thus, H1 was supported.

We hypothesized that the educational intervention reduces the intention to share fake news on social media (H2). The paired-sample t-tests for the intention to share fake news for the non-intervention group ($t\ (44) = -.71$, $p = .48$) and for the intervention group ($t\ (81) = .90$, $p = .37$) showed that the intervention had no significant effect in reducing fake news sharing. Hence, we found no support for H2.

We posited that the educational intervention significantly reduces general conspiracy beliefs (H3). The paired-sample t-tests for general conspiracy beliefs for the non-intervention (t *(44)* = 1.51, p = .14) and the intervention group intervention (t *(81)* = 3.06, p = .003) showed that the intervention had a significant positive effect in lowering the general conspiracy beliefs. Thus, H3 was supported. Table 3 shows descriptives per condition.

Table 3. Descriptives per condition.

	Before the educational intervention		After the educational intervention	
	Control group	Intervention group	Control group	Intervention group
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
PSML	4.16 (.54)	4.22 (.49)	4.35 (.34)**	4.44 (.29)**
Intention to share the news	1.89 (.88)	2.06 (.88)	2.31 (1.10)	2.19 (.99)
General conspiracy beliefs	2.87 (.85)	2.98 (.95)	2.91 (.79)**	2.64 (.91)**

Notes: N = 127; ** p < .01.

To test H4, H5a, and H5b, we applied model 7, PROCESS macro 3 in SPSS (Hayes, 2022), employing 5,000 bootstrap samples for each dependent variable. We tested the conditional effects of the educational intervention mediated by algorithmic awareness measured after the intervention on the intention to share fake news and on general conspiracy beliefs, considering intellectual humility as a moderator. The control group was used as a reference group.

We posited that the educational intervention enhances algorithmic awareness (H4). The educational intervention significantly enhanced algorithmic awareness (b = 2.93, SE = .94, 95% CI = [1.07, 4.78], p = .002). Thus, H4 was supported.

We posited that algorithmic awareness reduces (a) the intention to share fake news on social media and (b) conspiracy beliefs (H5). Algorithmic awareness has no significant effect on the intention to share fake news (b = −.05, SE = .13, 95% CI = [−.32, .22], p = .71) and reduced general conspiracy beliefs (b = .30, SE = .13, 95% CI = [.05, .56], p = .02). Therefore, H5a was not supported, and H5b was supported.

Regarding the moderating effect of intellectual humility, our findings showed that intellectual humility has a direct positive effect on algorithmic awareness (b = .30, SE = .13, 95% CI = [.05, .56], p = .02). The interaction effect between the educational intervention and intellectual humility has a significant negative impact on algorithmic awareness (b = −.65, SE = .22, 95% CI = [.05, .56], p = .004). The moderating mediation is significant for the general conspiracy beliefs (Index = −.43, *BootSE* = .17, 95% *BootCI* = [−.76, −.08], p = .01) and not for the intention to share fake news (*Index* = −.05, *BootSE* = .13, 95% *BootCI* = [−.32, 22], p = .71). At low (M = 3.69, SD = .5) and medium levels of intellectual humility (M = 4.19, SD = .5), algorithmic awareness enhances. However, high levels of intellectual humility (M = 4.69, SD = .5) significantly lower algorithmic awareness. Interaction effects are depicted in Figure 1.

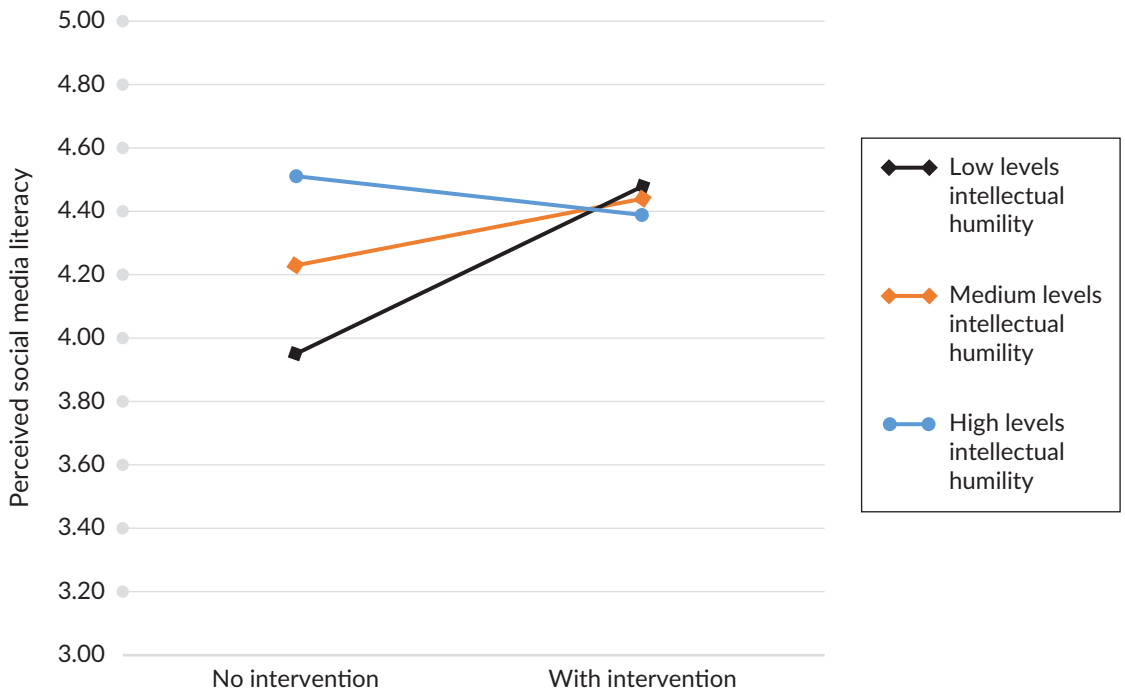

Figure 1. Interaction effects of the intervention moderated by the intellectual humility on the PSML.

5. Discussion

The study's main takeaway is that educational intervention effectively enhances PSML. Hence, our findings align with previous research on the impact of education on media literacy (Escoda et al., 2017; Nygren et al., 2022). In other words, young adults who participated in the presentation thought they knew more about how social media works from the perspective of technological skills, relationships on social media, information environment, and algorithmic awareness. However, the educational intervention did not significantly lower participants' intentions to share fake news on Instagram. Information environments are complex; there are several areas of disinformation, as we reflected in the various types of fake news in our survey (e.g., focusing on politics or the economy). Hence, there is no general solution to fight disinformation; there is a need for nuanced literacy interventions and other aspects to be considered.

Our research unveiled the moderating role of intellectual humility in the interaction between educational intervention and algorithmic awareness, the latter being a part of social media literacy. Thus, the educational intervention increased algorithmic awareness for lower and medium levels of intellectual humility. However, for high values of intellectual humility, the intervention has quite the opposite effect by lowering the PSML. Intellectual humility reflects critical thinking and the openness to learn new things, and high levels of intellectual humility intervention reduce its impact on PSML. Our findings have also highlighted the role of education in lowering participants' conspiracy beliefs (Lewandowsky et al., 2013; Pennycook & Rand, 2019).

6. Conclusion

This research contributed to a nuanced understanding of the impact of educational intervention in countering disinformation, as we highlighted the role of educational intervention beyond a skills-oriented

concept of literacy. However, our findings must be interpreted considering the study's limitations. First, the research was conducted with a convenience sample of university students with high self-reported social media literacy levels, and our sample included 86% women. Gender differences in social media usage are evident across various platforms. These distinctions manifest in the frequency and type of content shared by users, with females more inclined to share photos, especially on visually oriented platforms like Instagram, whereas males are more active in sharing images related to hobbies (Jambulingam et al., 2014; Thelwall & Vis, 2017). Therefore, future research should be conducted on gender-balanced samples. Second, our variables were self-assessed. Third, participants did not identify the news as fabricated before expressing their intention to share the post. Fourth, we did not include political knowledge and attitudes in our conceptual model, which are relevant variables in the complex information environment. And fifth, we did not measure the long-term effects of the educational intervention. Therefore, future research should investigate the long-term effects of educational intervention on a diverse sample.

The study has theoretical and practical implications by highlighting the role of educational intervention on social media literacy. With the moderating role of intellectual humility showing boundary conditions of the educational intervention at the individual level, we added to previous scholarship on the role of educational intervention in countering disinformation (Nygren et al., 2022) and the relationship between media literacy and critical thinking (Escoda et al., 2017). Educational interventions effectively enhance participants' perceived level of social media literacy. The intervention's value lies in its potential to boost efficacy, motivating individuals to apply critical thinking and literacy skills in media consumption consistently. However, it is also essential to recognize the limitations of focusing on efficacy alone, as high efficacy without corresponding skills could lead to overconfidence and potential neglect of the critical evaluation processes that media literacy seeks to promote.

Following Bandura's (1977) conceptualization of self-efficacy, while our intervention may have increased participants' confidence in their social media literacy, this does not necessarily equate to enhancing their skills. Moreover, we did not measure actual behavior in our study as our measurements were self-assessed, and we looked at behavioral intentions. Our research has implications for researchers, educators, and policymakers.

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Conflict of Interests

The authors declare no conflict of interests.

Supplementary Material

Supplementary material for this article is available online in the format provided by the author (unedited).

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A Flexible Framework Integrating Digital and Social Competences in Vocational Education Across Diverse Contexts

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Abstract

Competence frameworks in general education environments have emerged to define the knowledge, skills, and attitudes that contemporary educators need to acquire. Such frameworks have been less developed within vocational education and training (VET) although this sector is directly impacted by rapid and complex technological changes increasingly embedded in industrial and organisational demands of the working context. Many VET classrooms with dual or flexible contexts, with a range of demographically and culturally diverse learners, now require teachers to be trained with new competences and cross-cutting skills to cope with the resultant wider and deeper changes in knowledge. This article presents the outcomes and data of the design and validation processes of a competence framework combining digital and social skills. It was piloted in five countries (UK, Sweden, Germany, Italy, and Spain) to provide a flexible, and needs-based competence framework for VET teachers working with vulnerable learners. After conducting a literature review and a needs assessment of VET teachers and learners, a flexible three-domain framework is presented, with pathways and training methods that account for the so-called poly-contextual skills that combine digital and social skills. The flexible framework and 26 competences were tested with 358 VET teachers using three evaluation tools (self-assessment survey, game-quiz scores, and programme satisfaction survey). Conclusions highlight the need to combine digital and social skills together with media literacy through flexible pathways to achieve better results for teaching, learning, and empowering learners.

Keywords

competence frameworks; digital skills; self assessment; soft skills; vocational education and training; vulnerable learners

1. Introduction

Vocational education and training (VET) systems have traditionally been characterised as occupation-specific (European Centre for the Development of Vocational Training, 2024), leading to the acquisition of essential job knowledge, skills, competences, and work experience to enable effective functioning in an occupation or achieve integration into the labour market. However, the landscape within which VET systems now operate, the expectations laid on VET teachers—the skills they train for—have and are undergoing rapid transformation. This is a result of advances over recent decades in technological digitalisation, robotics, and automation of many existing industrial, business, and labour processes proceeding exponentially and now with applications emerging from AI ecosystems gradually diffusing across and into all aspects of human activity (Bushwick, 2023; Hirvonen et al., 2024). New and emerging technologies are creating digital inter-dependencies that are transforming institutional and organisational arrangements and the knowledge bases on which they operate (Bailey et al., 2022). This latter point is important if we accept that rapid technology diffusion means that new and adapted skills and competencies will have to take place over and regardless of obstacles of professional, sectoral, educational, and cultural distance (Jones & Miller, 2007). It is yet unclear as to where this will all lead.

Notwithstanding that uncertainty, at the macro level, VET systems are increasingly viewed by policymakers as critical for reskilling and upskilling dynamic workforces able to respond to these rapid techno-economic and societal changes (European Centre for the Development of Vocational Training, 2020). These systems are expected to play a significant role in sustainable competitiveness, social fairness and resilience, and as enablers of recovery and transitions to digital and green economies (European Commission, 2021). These policy imperatives indicate ongoing governmental and industry concerns and even anxieties as to how to provide a wide basis of generic and digital skills and competences to cope with rapid and unforeseeable technological changes affecting general populations. Essentially then, it is important to consider the values of digital humanism that focus on people in relation to technological advances in order to face the challenges posed by the latest technological developments (Fernández-Fernández, 2021). Technology has to be used to improve the quality of life of all people, however, as Habermas and Husserl (1995) stated, the interests of knowledge condition the fact that technology is not neutral and objective. Implicit then in many policy and political statements is the underlying notion that VET must also be fundamentally concerned with the social, creativity, and whole-person development of individuals, rather than focusing only on occupational skills that facilitate entry into the labour market. It recognises intersectionality, class, race, age, gender, the workless, those in precarious employment, and unemployed youth cohorts. Certain groups are particularly vulnerable often leading to social exclusion: migrants who are the target of numerous discourses in the media (Blanco et al., 2022), women who are victims of sexism and digital violence (Malquín-Robles & Gamir-Ríos, 2023), or elderly people who suffer more directly from the digital gap (Mohan et al., 2024). VET teachers and their students are acutely exposed to rapid technological transformations. They must acquire and maintain ongoing knowledge of occupation-specific hardware and software whilst at the same time consolidating the use of digital tools into their pedagogical and didactic practices (Lahn & Berntsen, 2023). They are expected to deliver high-quality training, foster technical and digital skills, and through innovative training methods including in virtual environments in line with state-of-the-art vocational and digital pedagogic work with digital learning tools in diverse and multicultural environments (Mulyadi et al., 2019).

In coping with such demands and transformations, several teacher competences frameworks have emerged to define the knowledge, skills, and attitudes that contemporary educators should acquire from a myriad of

approaches to teacher education and professional qualification standards (see the compilation by UNESCO-UNEVOC, 2023). The specificity of VET as a diverse, labour-specialised, and empowering system now requires a set of competences for polycontextual training and boundary-crossing learning environments encompassing an understanding of class, online, work, enterprise, labour market, outreach, social responsibility, entrepreneurism, etc. (Down, 2011; Esmond, 2020; Harreveld & Singh, 2009; Sauli et al., 2021). Within this landscape, some VET-specific teacher frameworks have evolved to combine digital and professional competences: including mentoring technology-enhanced pedagogy, digital teaching professional framework, VET teachers embracing digital disruption, VET teachers and embracing the digital disruption, technical and VET teachers' digital competence model, and recently DigComp4Vet. However, the focus of these frameworks is on teachers' development of competences in using digital resources and teaching along with subject-specific, industry-specific, and employability skills, whilst competences related to learning assessment and empowering learners are less frequent, lacking in a combination of technical and non-technical skills, and omitting processes of how to embed digital citizenship in VET teaching and teacher education (Nylund et al., 2019; Rönnlund et al., 2019; Rosvall & Nylund, 2022)

Further, to the acquisition of digital and professional skills, the Osnabrück Declaration (European Commission, 2021) asserted that VET systems need to combine these challenges with those arising from climate change and the consequences of Covid-19. Cutting across all societal areas, the major global challenges of the UN Sustainable Development Goals 2030 have highlighted the need for combined and comprehensive training in both digital skills and other social, soft, or specific skills for inclusion and progression towards more equitable and sustainable societies (McGrath & Ramsarup, 2024; OECD, 2019; UNESCO, 2017). In sum, fluid technological diffusion, the commitment to societal challenges, and the constant demands from evolving labour markets are requiring VET teachers to train learners in a wide range of competences for maximum applicability, to meet VET functions of upskilling and reskilling. Critically, this is in contrast to the reality of many VET classrooms with dual or flexible contexts, with a range of diverse and often vulnerable students (Vermeire & Van den Broeck, 2024) and with teacher profiles in dealing with the digital divide and possibilities of exclusion (Nguyen, 2020). Many of these teachers' competences frameworks do not fit all solutions, neither consider the teacher's needs nor their own starting competence levels, but to offer top-down domains of teachers' professional activities, usually from a rigid progression level, and rarely from a standpoint of how to achieve flexible acquisition. The FLEXI-COMP project is a response to these many requirements aiming to deliver an innovative curriculum, applicable throughout the European VET area, for supporting the acquisition and application of digital and social competences of educators, so that they can in turn work with disadvantaged VET learners and excluded youth to improve their own social and digital inclusion. Disadvantaged learners can be defined as those faced with difficulties in adapting to the educational environment, low levels of curricular competence, difficulty in accepting the educational institution's operating rules, conflicts among peers, low self-esteem, and lack of motivation (Griffin, 2014) who experience a range of marked difficulties throughout their school career that prevent them from benefiting from the curriculum and classroom learning and barriers that are emotional, familial, or socioeconomic. Together all these factors can lead to social exclusion from access to learning environments.

2. Towards a Flexible Competence Framework

The FLEXI-COMP project's starting point was how to develop a flexible digital competence framework for VET educators. Such flexibility seeks to overcome the rigidity of generally in-use current frameworks, which

are standardized and based on linear progression, and may not be responsive to different student profiles and training needs. To this end, the project included three phases, as follows: (a) a review of the state of the art in measuring digital competences of VET educators, (b) a needs assessment pre-study on skills of 53 VET educators and 80 learners in five European countries, and (c) the design of a flexible competences framework and its piloting via a course with 358 VET educators.

2.1. Measuring Digital Competences of VET Educators: State of the Art

The state of art review indicated that progress has been made in improving teachers' digital literacy, but there are still deficits (Lahn & Berntsen, 2023; Martínez-Izaguirre et al., 2021; Villarroel & Stuardo, 2022) that need remedying to ensure that VET educators mastered the competences that will be key to their students' development. Firstly, studies found low levels of digital literacy development in relation to techno-pedagogical domains (Burns & Kanninen, 2023; Lahn & Berntsen, 2023), leading to unambitious intentions to use digital tools in the classroom. In this regard, other studies have shown that VET teachers' attitudes towards the use of technology are a determining factor for digital self-efficacy (Antonietti et al., 2022; Lahn & Berntsen, 2023; Ulfert-Blank & Schmidt, 2022), whilst others highlighted infrastructure deficits or difficulties in the ethical, legal, and safe use of technologies (Heine et al., 2023; Santi & Kustiawan, 2023). Secondly, studies found that educator age and education levels are conditioning factors in the acquisition and improvement of teaching skills, as VET teachers have lower levels of self-perceived digital teaching skills competences compared to teachers at other levels of education (Betancur & Muñoz-Repiso, 2023; Cattaneo et al., 2022), with evidence of greater time investment for older teachers coping with digitalisation (Burns & Kanninen, 2023). Thirdly, another set of studies highlights shortcomings specifically related to the volatile and complex context of VET. These studies emphasize the need for teachers to acquire competences tailored to specific needs, such as addressing the diversity and vulnerability of VET learners through care and inclusion (Atherton et al., 2019). They also stress the importance of ensuring that competency frameworks connect school and work-based learning environments (Lahn & Berntsen, 2023), adaptive to various teaching situations and roles, such as dual education (Dillenbourg et al., 2022), and provide teachers with autonomy for personalized teaching at this educational level (Lyckander, 2021; McGrath & Ramsarup, 2024).

The review showed that, although studies provide evidence of the training deficits of VET teachers, there is a limitation related to the lack of consensus on the concept of digital literacy in teaching (Skantz-Åberg et al., 2022) and to the instruments used to assess the acquisition of competences by teachers, which are based on the self-perception of knowledge or skills, but not on the actual performance of teachers (Mattar et al., 2022; Párraga et al., 2022). However, it has also been found that the use of self-perception tools does help teachers to become aware of deficiencies and training needs (Clifford et al., 2020) and that, as other studies have shown (Cattaneo et al., 2022; Lahn & Berntsen, 2023), some research with VET teachers has used instruments created or validated for other levels of education but not specifically for VET (Lahn & Berntsen, 2023; Mattar et al., 2022), with the SELFIE instrument, created for the DigCompEdu framework dominating (Munar Garau et al., 2024; Párraga et al., 2022).

2.2. VET Educators and Learners Qualitative Needs Assessment

Complementary to the literature review, the FLEXI-COMP project developed a qualitative research approach using lifeworld analysis (LWA) methodology to understand the digital experiences and needs of

VET educators, as well as those of disadvantaged learners (Patton, 1990). This method provided an understanding of how shared meanings about the digital world are constructed (Ashworth, 2003; Dahlberg et al., 2008) with "relational research" focusing on the key challenges, or "critical incidents" VET educators face working in teaching and learning situations with vulnerable learners (Finlay & Evans, 2009). These approaches aim to empirically document and understand individual lived experiences focusing on areas such as a sense of being in the world and the construction of "coping strategies."

In this qualitative pre-study, the main objectives were to understand and capture the barriers and challenges that inhibit the use of digital tools in teaching and learning. LWA aimed to capture the "lived experience" of FLEXI-COMP's target groups: VET educators and VET learners from vulnerable groups.

Regarding the sample of educators, a total of 53 VET educators participated, with six interactive focus groups involving 29 educators and 23 individual structured interviews with educators from Italy, Spain, Sweden, and the UK, without participants from Germany. The majority of participants (57%) were in the 36–50 age group, 31% were in the 51–65 age group, and 12% in the under 35 age group. No significant differences in age were identified across the participating countries. Slightly more females (53%) were represented than males. The participating cohorts showed a spread across the spectrum of VET teaching experience, from less than one year to over 30 years, and most VET educators (67%) self-reported a high or very high level of digital competences, with only 12% rating themselves low.

Regarding the experiences of using digital tools and challenges faced in everyday life by vulnerable and disadvantaged learners, data were collected through nine interactive focus groups involving 80 learners from Italy, Spain, Germany, Sweden, and the UK. All participants were in the 16–25 age group. Females were under-represented, with males constituting 73% of participants. A quarter of participants identified as belonging to a minority ethnic group, either first or second-generation. A large majority (71%) of learners self-reported a moderate or low level of digital competences, 22% rated themselves high, and 7% very high.

The data obtained from the interactive focus groups and structured interviews were analysed using a phenomenological content analysis methodology based on "reduction" (Creswell, 1998; Patton, 1990; Willig, 2001). This process entailed transcription of data recordings, bracketing and phenomenological reduction, delineating units of general meaning, delineating units of meaning relevant to the research question, independent verification, eliminating redundancies, clustering units of relevant meaning, determining themes from clusters of meaning, summarising individual interviews and focus groups, triangulation of summaries, identifying general and unique themes for all the summaries, contextualization of themes, and composite integrated summary. The approach included analysis of the themes identified set against participant profiles and settings, comparing participant roles (educator/learner), demographics (age and gender), teaching role and experience, and digital competences. Patterns identified in relation to these factors were reported in the analysis.

Results from the LWA research reinforced the main findings of the literature review. It highlighted as key challenges: VET educators' workload pressures; lack of institutional and management support for continuing professional development, particularly in the area of digital skills; uneven access to digital infrastructure, tools, IT support, and financial constraints on training—including the "opportunity costs" of participating in training. One consistent challenge identified by the participating VET educators was working with

disadvantaged learners with low and variable skills and motivation. Key digital, media, and information competence gaps highlighted for VET educators covered: understanding the functionalities of different tools and their applicability in different teaching and learning scenarios; "techno-pedagogic" skills; learning personalisation and adaptation, particularly the ability to customise learning for vulnerable learners presenting with multiple and specific needs; and applying digital tools and practices to support learners in developing their vocational life and online safety and security. The highlighted pedagogic needs for VET educators included: hybrid environments delivering "blended" training (online and face-to-face); flexible training enabling adaptation and personalisation; collaborative learning and interactivity; supporting experimentation and problem-solving, and adapting teaching to students with disabilities, specific education needs, and variable abilities.

The LWA research also confirmed that VET learners, particularly those who are disadvantaged, often have negative previous experiences of formal education and find it difficult to flourish in a conventional teaching environment. This experience has been reinforced for many disadvantaged learners by a lack of confidence in using digital tools, a sense of "digital inadequacy" and a fear of failure in engaging with the digital world. Key digital, media, and information competence gaps highlighted for VET learners covered: core digital skills; awareness of the different digital tools that are available and what they can be used for; online safety and security; and industry-oriented skills. The pedagogic needs for VET learners emphasise the need for a flexible learning environment that reduces barriers between teacher and students, increases the range of educational modalities and spaces to work in, and increases both teacher–student and student–student interactivity. The LWA research suggested that disadvantaged VET learners require a "scaffolded" pedagogy that enables adaptation to learning profiles and circumstances. It supported the development of a holistic and multi-disciplinary training programme combining technical skills, social skills, interpersonal skills, and skills specifically oriented to the needs of disadvantaged learners, including helping to prepare for integration with the labour market as, for example, the support to keep pace with ongoing developments in digital technology, VET, and industry.

2.3. FLEXI-COMP Framework Domains and Competences

Based on the results of the literature review and LWA, a competence framework was developed which sets out the digital, social, and pedagogic skills VET educators need to work effectively with learners, particularly those who are disadvantaged, in order to more deeply develop learners' digital skills. The three domains, shown in Figure 1, develop knowledge, skills, and attitudes within competences as an open set of changeable examples rather than a discrete set of immovable structural entities (Valenta et al., 2013). Competences are therefore defined as a dialectical progression of knowledge, skills, attitudes, and purposes, where broader competence areas derive from the socio-economic context and are translated into learning outcome examples.

The framework specifies three "high level" competence domains mixing digital and social skills. Domain A—the core (generic) digital competences—covers the basic digital competences VET educators would need to apply digital tools successfully in their practice. Domain B—enabling digital competences—focuses on supporting VET educators in collaborating with learners in the classroom and facilitating their acquisition and application of digital skills. Domain C—FLEXI-COMP specific competences—focuses on the need to apply digital tools to support the needs of learners in the VET sector, as well as the need to equip VET educators with the soft skills needed to work with disadvantaged people in that sector. These three domains are associated with eight

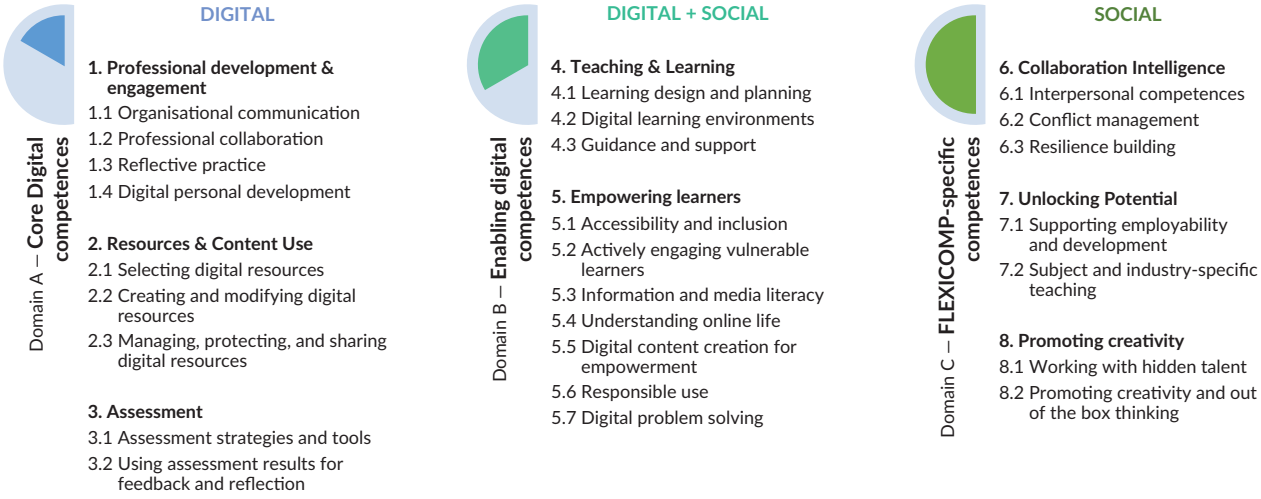

Figure 1. FLEXI-COMP's digital competences framework (see Supplementary File, Appendix 1, for a detalied explanation of domains, competences, and subcompetences).

competence areas. Each competence area covers a set of specific competences, providing 26 competences in total within the framework. Each competence describes the learning outcome associated with it.

The competence framework is the basis for the FLEXI-COMP VET training programme, an online course structured into eight "topics" corresponding to the eight competence areas in the framework. The course, delivered by Moodle, combines three types of teaching methods, which have been selected to suit the life and work style of VET educators and their professional development needs, in particular, the need to reduce the time and resources required to learn, as evidenced in the LWA phase. Teaching types are: micro-training, delivering knowledge through short video resources; podcasting, which replicates the video resources in audio format; and written text that complements the other types and covers the topic in more depth. These three types contribute to learning personalisation and flexibility because they encourage educators to customise the training course to their needs, for example by taking advantage of the resources and reference material provided in the course. Additionally, each topic starts with an interactive game (see Figure 2) which introduces the scope and "landscape" by presenting scenarios of "critical incidents" educators are likely to face in their practice, and to solve them by applying the appropriate behavioural response. The eight situational knowledge-based scenarios were produced from the LWA data and were required to be solved by applying the competences covered by the topic in actual teaching practice, posing a

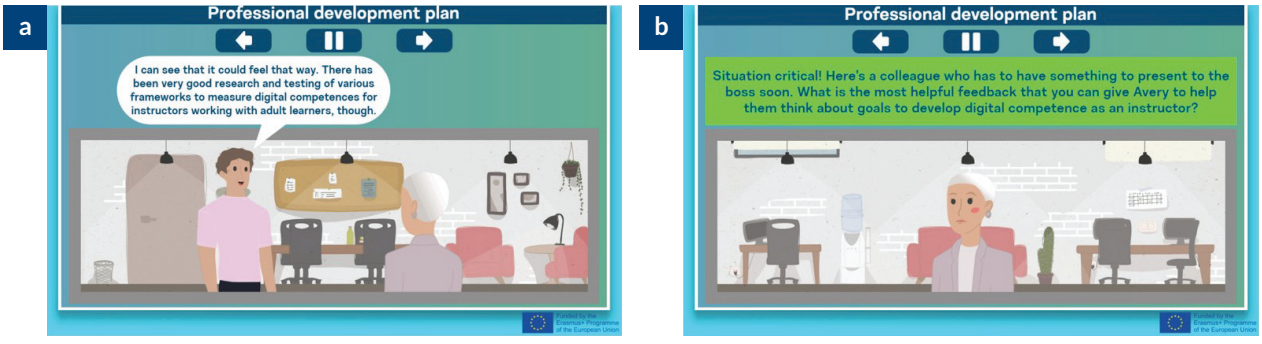

Figure 2. Example of FLEXI-COMP game scenario topic one starting (a) and ending with the critical incident (b).

challenge quiz with three responses. The game quizzes in the eight topics served an important "embedding" assessment function, helping educators to assess how much they have learned and, more importantly, to identify the gaps in their knowledge and its application.

3. Method

3.1. Procedure and Instruments

Evaluation of the competence framework and the 26 competences was "theory-driven" (Pawson & Tilley, 1997) and used change theory to assess the extent to which the programme had an effect on the "presenting problem" addressed: the low level of VET digital and social competences of educators. In other words, how the use of programme resources by participants changes their "reasoning" and how this ultimately leads to changes in behaviour, practices, and systems (Befani, 2012). To this aim, the programme piloting used three evaluation tools: self-assessment survey, game-quizzes scores, and programme satisfaction survey, described as follows.

The self-assessment survey with a "pre-test/post-test" questionnaire of training programme participants was conducted to measure their self-assessment level of competences before and after participating in the training programme; for each competence a question on knowledge and application were created, with simple examples ensuring readability and understanding with a group of piloting teachers. The survey asked teachers to rate their level of competence on a five-point scale from *very low* to *very high*. To cover immediate outcomes—changes in awareness and increased knowledge—educators were asked to rate their level with 26 questions of knowledge and 26 of application for each competence with specific examples (see Figure 3).

The game quizzes were implemented at the end of each topic. Participants were provided with a set of questions based around a "scenario challenge" that they were asked to solve using the learning derived from the training programme (see Figure 4). Selection of a particular choice option provided a reasonable consideration of a participant's competence efficacy with feedback. The game-quizzes scores were shown at the end of each module as the result of educators' self-reflection; the choice options were graded from 1 *incorrect* (0%), through 2 *partly correct* (60%), to 3 *fully correct* (100%).

The programme satisfaction survey covered two evaluation dimensions: the user experience and satisfaction with the programme content. User experience is subdivided into three evaluation criteria: meeting educator

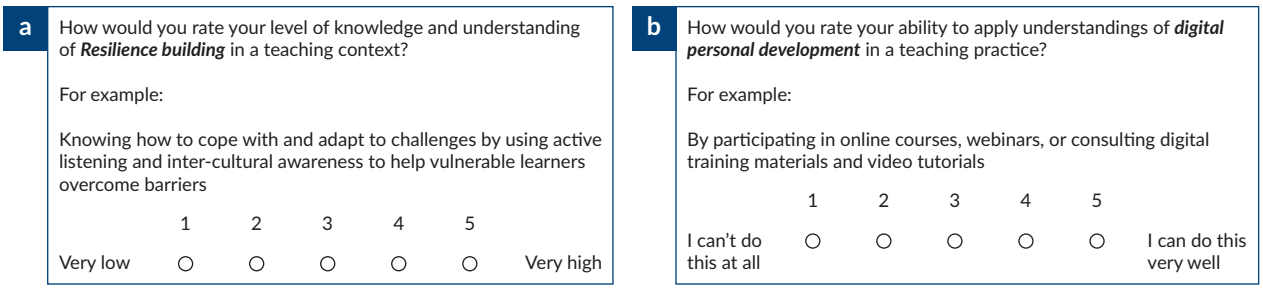

Figure 3. Examples of items for knowledge (a) and application (b) in the self-assessment survey.

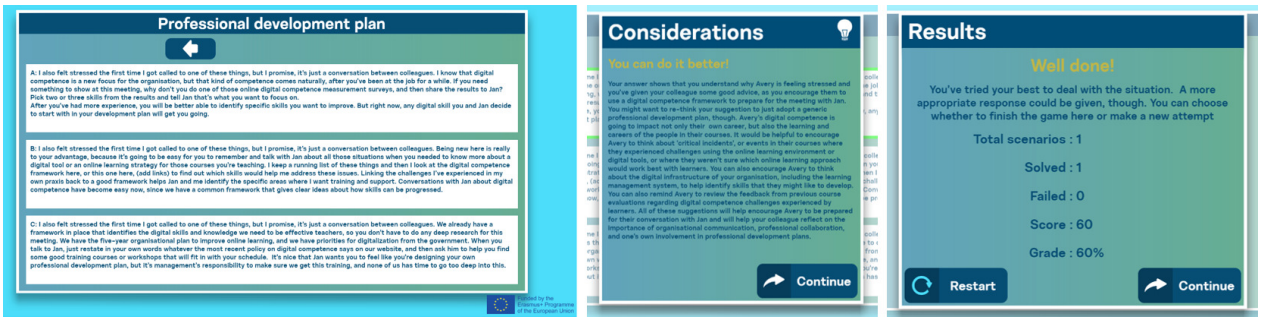

Figure 4. Example of game-quizzes items with three answers, considerations, and results with scores.

needs (coverage of training needs, ease of understanding of the programme content, relevance of the programme to continuing professional development); outcomes (measuring the degree of improvement and teaching of digital competences, application to teaching practice and usefulness); and technical usability via user-friendliness. For each indicator, survey respondents were asked to rate the programme using a Likert scale from 1 *very dissatisfied* to 5 *very satisfied*. The satisfaction with the eight modules of the training course was measured using the same scale.

The analysis of the three evaluation tools uses descriptive and comparative statistical measures (pre- and post-means t-test), without disaggregating the results by country, in order to measure the effects of the training programme from the implementation of the FLEXI-COMP competences.

The reliability of the scales used in the competence self-assessment questionnaire was assessed using Cronbach's alpha. On entry, the analysis showed an alpha co-efficient of 0.9537 for Domain A, 0.9606 for Domain B, and 0.9347 for Domain C. On exit, the analysis showed an alpha co-efficient of 0.9558 for Domain A, 0.9654 for Domain B, and 0.9401 for Domain C. This shows an excellent internal consistency across all three domains and for the questionnaire as a whole.

3.2. Sample

The competence framework and training programme were validated and pilot-tested with 358 VET educators from five countries: Germany, Italy, Spain, Sweden, and the UK. Participants were recruited to the programme through VET centres, vocational schools, higher education establishments, and community-based providers of digital training, to ensure representation across the main VET sectors. The recruitment process was designed to include a significant proportion of educators working with disadvantaged learners, those working with minority ethnic learners, migrants, not in education, employment, or training, and people with cognitive disabilities. The participants represent a broadly equal gender distribution.

During the process of piloting, of the 358 educators enrolled, 212 (60%) completed the programme. Spanish VET educators constituted the largest proportion of enrolled participants (96%), followed by Italian educators (20%), and below 20% for the UK, Sweden, and Germany. From them, 205 educators (96%) completed the pre-test self-assessment survey and 193 (91%) the post-test survey. Game quizzes were analysed from 212 educators, and the programme satisfaction survey was answered by 193 educators.

4. Results

Analysis of the self-assessment survey comparison between pre-post rates (see Figure 5) shows the change in aggregated mean educator score for the three domains of the training programme as well as the total combined competence score after completion of the training programme. The aggregate scores for each domain were calculated as a percentage of the total maximum percentage score, combining the scores for each 26 competences in each three domains, and the total score for the three domains combined. The confidence intervals for Domain A—combining knowledge and application score changes—were 18.6 and 24.2, for Domain B were 18.3 and 24.8, and for Domain C were 16.2 and 22.3 at the 95% confidence level.

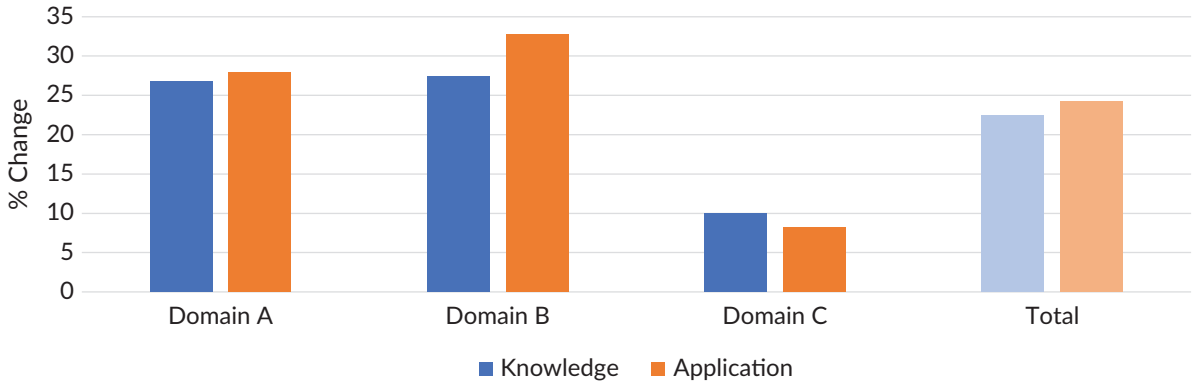

Figure 5. Change in digital competence scores comparing pre-post survey results.

Figure 5 shows that in Domain A, VET educators who completed the course increased their aggregate "knowledge" competence score by 27%, from an average of 65/100 to 82/100, and their aggregate "application" competence score by 28%, from an average of 64/100 to 82/100. In Domain B, VET educators increased their aggregate "knowledge" competence score by 27%, from an average of 64/100 to 82/100, and their aggregate "application" competence score by 33%, from an average of 61/100 to 81/100. In Domain C, VET educators increased their aggregate "knowledge" competence score by 10%, from an average of 65/100 to 71/100, and their aggregate "application" competence score by 8% from an average of 66/100 to 71/100. Overall, VET educators who completed the course increased their aggregate total "knowledge" competence score by 21%, from an average of 65/100 to 79/100, and their aggregate "application" competence score by 23% from an average of 63/100 to 79/100.

A student's t-test using a matched pair comparison of VET educators which combined domain and total competence pre- and post-survey data was run, adding together the ratings for each competence for each participant, showing that the difference in competence levels was notably statistically significant, as Table 1 shows.

Large increases in competence levels in each of the three competence domains and overall were replicated in the analysis of changes in self-rated competence levels across each of the 26 competences covered in the training programme. Generally, educators increased their competence levels across the board in all 26 competences covered by the training course, both in terms of "knowledge" and in "application," as shown in the Figures 6, 7, and 8. In Domain A (shown in Figure 6), the biggest increases in competence levels were for:

Table 1. Student's t-test, matched pair sample, educator competence scores before and after the training programme.

	Domain A	Domain B	Domain C	Combined
Mean pre-test	57.6	63.3	46.6	167.5
Mean post-test	73.6	81.5	58.1	213.2
t-Stat	15.38307982	14.16574912	13.55417287	15.55802032
P($T \leq t$) one-tail	4.25214E-31	3.2656E-28	9.69273E-27	1.65756E-31
t critical one-tail	1.656940344	1.656940344	1.656940344	1.656940344
P($T \leq t$) two-tail	8.50429E-31	6.5312E-28	1.93855E-26	3.31513E-31
t critical two-tail	1.978819535	1.978819535	1.978819535	1.978819535

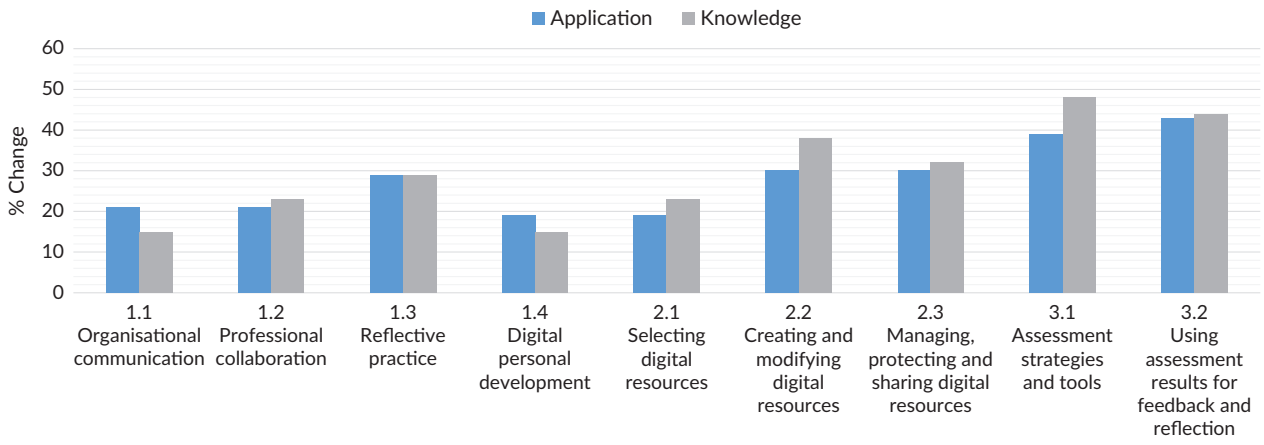

Figure 6. Changes in competence scores in Domain A—Core digital competences.

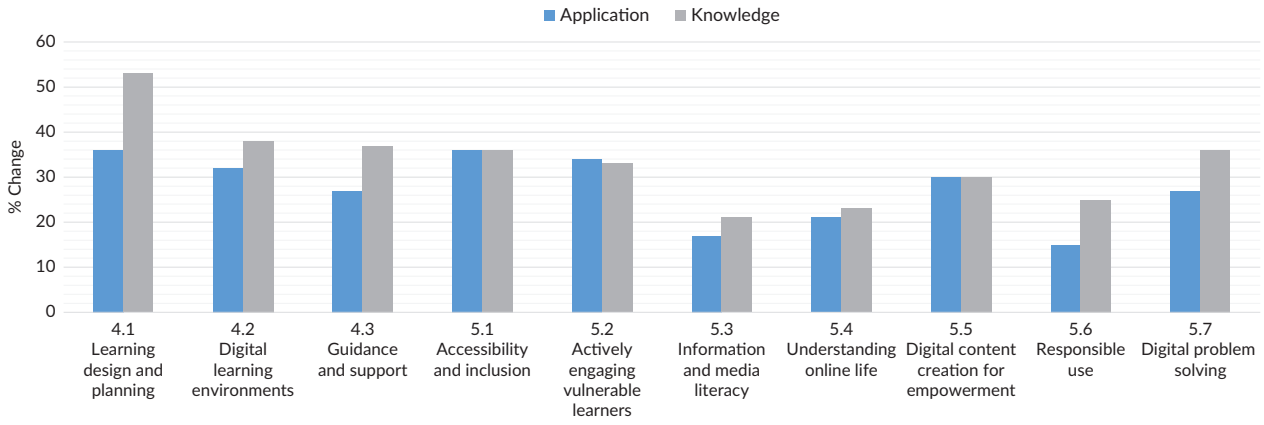

Figure 7. Changes in competence scores in Domain B—Enabling digital competences.

"assessment strategies," which increased from an average score of 2.9 to 3.9 on knowledge, and 2.8 to 3.9 on application; "using assessment results for feedback," which increased from an average score of 2.8 to 3.9 on knowledge, and 2.8 to 3.8 on application; and for "creating and modifying digital resources," which increased from an average score of 3 to 3.8 on knowledge, and 2.8 to 3.8 on application.

As Figure 7 shows, educators also increased their competence levels across the board in Domain B, both in terms of "knowledge" and "application." The biggest increases in competence levels were for: "learning design and planning," which increased from an average score of 2.9 to 4 on knowledge, and 2.9 to 3.9 on application; "accessibility and inclusion," which increased from an average score of 3.1 to 4 on both knowledge and application; and for "engaging vulnerable learners," which increased from an average score of 3 to 4.1 on knowledge, and 3.1 to 4 on application.

As Figure 8 shows, educators increased their competence levels across the board in Domain C, both in terms of "knowledge" and "application." The biggest increases in competence levels were for: "working with hidden talent," which increased from an average score of 2.9 to 4.1 on both knowledge and application; "promoting creativity," which increased from an average score of 3.1 to 4 on both knowledge and application; and for "supporting employability," which increased from an average score of 3.1 to 4.1 on knowledge, and 3.3 to 4.1 on application.

Besides the self-assessment, according to complementary measures from game quizzes, the mean grades for the educators for each of the eight programme modules were higher. These game quizzes indicated that educators who completed the training programme achieved a high level of competence, with an overall mean grade of 8.2 and no module achieving a mean grade of below 7/10. The highest mean grades were for Topic 6 Collaboration Intelligence, with a mean grade of 8.8, and Topic 2 Resource and Content Use, with a mean grade of 8.8, while the lowest for Topic 3 Assessment, and Topic 7 Unlocking Potential with mean grades of 7.3 and 7.5 respectively.

Finally, on the complementary programme satisfaction survey, Figure 9 shows how VET teachers rated the training programme on the three key user experience criteria, meeting educator needs, training outcomes and technical usability/user-friendliness, together with their satisfaction with the training programme overall, and how they rated the programme content overall.

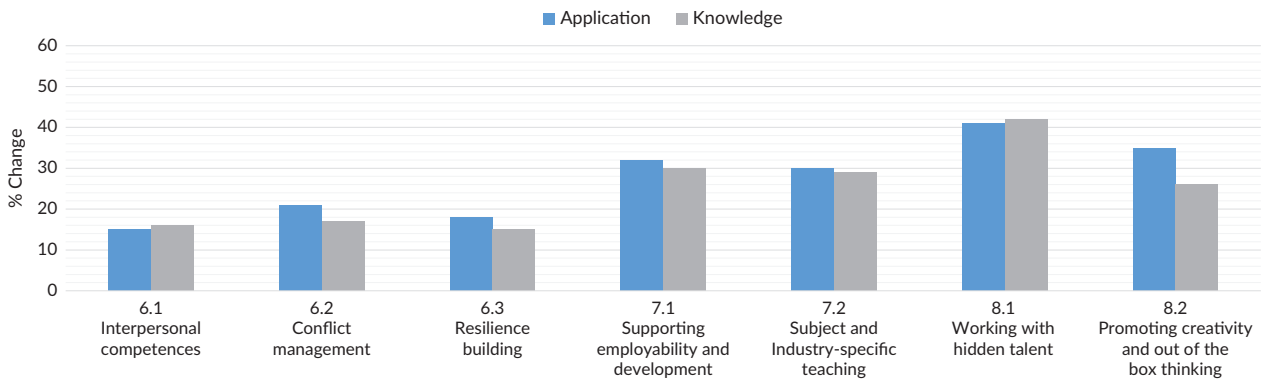

Figure 8. Changes in competence scores in Domain C—FLEXI-COMP-specific competences.

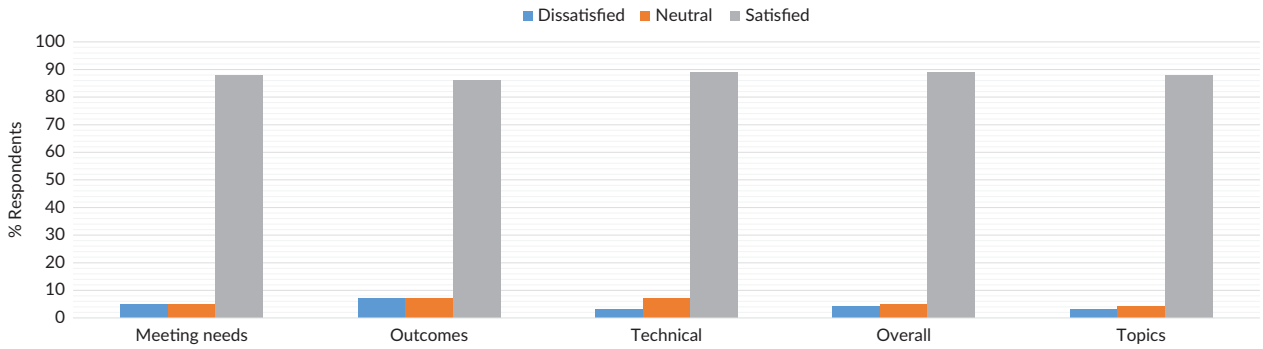

Figure 9. Training programme experience and user satisfaction.

As Figure 9 shows, on meeting needs, 88% of survey respondents said they were satisfied or very satisfied with how the training programme met their needs, with only 5% dissatisfied or very dissatisfied. In terms of outcomes, 86% of survey respondents said they were satisfied or very satisfied with how the training programme had contributed to positive outcomes for their teaching practice and professional development, with only 7% dissatisfied or very dissatisfied. Fifty-three percent of survey respondents were satisfied and 31% very satisfied with the extent to which participating in the programme had led to improved teaching outcomes and 56% were satisfied and 31% very satisfied with the extent to which the programme had contributed to improved teaching practice. With regards to the technical aspects of the programme, 89% of survey respondents were satisfied or very satisfied with only 4% dissatisfied or very dissatisfied. Evaluation of participant satisfaction with the programme content showed a high level of satisfaction overall and with the content provided in each of the eight modules—88% of survey respondents were satisfied or very satisfied with the programme content and only 4% dissatisfied or very dissatisfied.

5. Conclusions

VET clearly has an important role in tackling disadvantages across many demographic cohorts. However, the rapid and subsequent ubiquity of ICT and related new, emerging, and often unexpected technological developments are creating barriers to access and learning use for many within those cohorts, especially those unemployed and socially peripheralized, presenting problems for VET educators. Large-scale competence frameworks have been developed but most offer static tools not often appropriate in fluid and changing VET sectors. They usually rely on the one tool of self-assessment. They may even hinder the continuous achievement of disadvantaged learners who are unable to navigate an increasingly hyperconnected world where digital cross-walking is a feature of how people acquire knowledge, skills, and form attitudes. The boundaries between what is pedagogical, what is social, what is instructive, and what is aspirational are increasingly blurred. The starting point of the FLEXI-COMP project was a methodological consideration of how we begin to unpick those boundaries.

The FLEXI-COMP approach has demonstrated that the voices of VET teachers, educators, and their students are crucial in developing effective and flexible polycontextual needs-based competence teaching and learning approaches that have efficacy for VET training programmes and curricula. The LWA, listening to the voices of VET educators, clearly highlighted the difficulties faced by VET educators: workload pressures; lack of institutional and management support for continuing professional development, particularly in digital skills; uneven access to digital infrastructure and digital tools, and IT support and financial constraints on training,

including the "opportunity costs" of participating in training. The design of a competence framework with different teaching methods and game quizzes with real-context incidents is shown to address teachers' and learners' demands for flexible learning pathways that combine digital and social skills. This supports the need to develop frameworks without rigid areas or levels, but interconnected areas in combination. In this sense, FLEXI-COMP evolves from DigCompEdu (Redecker & Punie, 2017) with two more areas of social competences (collaborative interlinking and creativity) and competences for professional preparation, in line with areas of competences that are part of specific frameworks for VET, such as the digital teaching professional framework (Education & Training Foundation, 2018), the VET teachers embracing digital disruption (VET-TEDD, n.d.) and the technical and VET teacher's digital competence model (Lee et al., 2022).

The piloting results of FLEXI-COMP, and contrary to other studies with only one instrument for self-assessment, two more contrasting measures reinforce the picture. Many programme participants stated that they had gained new knowledge and ideas, learned about new digital tools and social skills, as well as how to apply these tools in their teaching practice. Learning design and planning competences were highlighted as being greatly enhanced through the FLEXI-COMP approach. The need to combine digital and social skills within flexible pathways to achieve that combination was positively evidenced in this project since the changes in knowledge and application were found for Domain B which included digital and social skills for teaching, learning, and how to empower learners.

The project also showed the need to further explore how to reinforce or develop new assessment skills and competences that can more effectively prepare students and learners for dynamic and rapidly changing labour markets. Competence frameworks for VET educators and learners should not then simply include technical skills but should deliver a holistic approach incorporating technical, methodological, social, and interpersonal skills, including social and communication skills, teamwork, and autonomy. Learning processes can be elevated within VET teacher training programs, but generalization of what methodologies and processes are used is complex due to the extensive variety of VET levels, grades, and courses and there is as yet no agreed framework for VET digital and social competences. It is clear that further research is needed, as new or reworked competences for use within VET must be developed at a pace that goes beyond the technological and methodological aspects and rooted in participatory and social dimensions.

This study can provide highlights for flexible training for VET educators for two main reasons. First because, as our literature review and LWA highlighted, VET educators engage on a daily basis with learners who present with a wide range of profiles, learning histories, and learning needs and they work in highly diverse teaching and learning environments. This requires a competence framework in which knowledge, skills and attitudes are considered within competences as open sets of changeable examples of learning outcomes rather than discrete sets of immovable structural entities (Valenta et al., 2013). Second, the demands of the job put significant limitations on continuing professional development for VET educators, which means that digital competence training needs to be adaptable and customisable.

In the area of policy recommendations and application, FLEXI-COMP has revealed several areas of relevance. First, a conduct comprehensive needs assessment to understand and locate specific digital skills gaps among VET teachers and educators. Second, developing flexible and adaptive training that covers a wide range of digital skills from basic digital literacy to advanced technology integration, combining digital with social skills. Flexibility is achieved and supported through a self-assessment tool enabling VET educators to highlight

their digital strengths and weaknesses and subsequently personalise their training accordingly. Third, a need to encourage teachers to collaborate on projects that address real challenges in their VET settings using critical incidents. The pedagogic approach adopted in the training programme supports the acquisition by VET educators of the practical skills needed to apply digital tools and techniques to suit different learner profiles and needs. And lastly, allowing the collection of feedback from both participants and facilitators to make iterative enhancements to the training framework. This is important because objective and subjective measures can be combined via self-reporting, for effective practice and acquisition of competences.

Limitations and recommendations for future studies include the use of combined and varied assessment tests and tasks for competence acquisition, along with longitudinal effects. The assessment of competence before and after the training course was implemented using a multi-method design that triangulated self-reported competence scores, user responses to quizzes in the interactive game, and a user satisfaction survey. Although this approach aimed to maximise the reliability and robustness of the evaluation results, the use of self-report measures is an obvious limitation of the study. However, the use of quiz scores in the evaluation could be seen as a compensatory "objective" measure, as they are based on the application of acquired competences rather than self-reporting. Future studies could use a combination of methods, using a performance test or the use of longitudinal scales that measure the application of acquired competences through observation of teachers or their performance tasks.

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Conflict of Interests

The authors declare no conflict of interests. The Ethics Committee from the University of Salamanca (Spain) approved the different phases of the design and piloting on 14/02/2022 (project 747).

Supplementary Material

Supplementary material for this article is available online in the format provided by the author (unedited).

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ARTICLE

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Developing Performance Tests to Measure Digital Skills: Lessons Learned From a Cross-National Perspective

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Abstract

This article discusses the development of task-based performance tests designed to measure digital skills among children aged between 12 and 17 years old. The tasks reflect authentic everyday situations to evaluate skill levels. The primary objective is to design performance tests that provide a comprehensive understanding of children's digital skills. The tests cover three distinct skill dimensions: (a) information navigation and processing; (b) communication and interaction; and (c) content creation and production. These include several subdimensions, offering a detailed perspective on children's digital skills. The development process itself revealed several methodological challenges that needed to be addressed, yielding valuable lessons for future applications. Key lessons from our cross-national experiences include the importance of involving children early in the design process, using a combination of open-ended and closed tasks, and allocating ample time to walk through the coding scheme.

Keywords

children; children's digital skills; cross-nationally applicable tasks; digital skills; international performance tests; performance tests; performance test development

1. Introduction

Digital skills are indispensable for participation in an increasingly digital society. They are associated with a wide range of online opportunities, ranging from civic and social engagement to cultural, economic, or health benefits (Cortesi et al., 2020; Livingstone et al., 2021; Rodríguez-de-Dios et al., 2018). Early

conceptualisations focused mostly on technical operations (e.g., operating devices or using software) and information searching (e.g., defining keywords; Bawden, 2001; Kolle, 2017). The advent of Web 2.0 broadened this initial understanding to include skills required for online communication and interaction and the production of online content (Helsper et al., 2021; Iordache et al., 2017; Siddiq et al., 2016; van Dijk & van Deursen, 2014). Despite these advancements in conceptualisations, many studies continue to employ limited operationalisations restricted to technical and information skills.

In addition to conceptualisation issues, recent literature reviews show that most measures use self-assessments, wherein children evaluate their proficiency across various digital skills (Haddon et al., 2020; Livingstone et al., 2021). Such self-assessments provide rough proxies for actual skill levels and require careful interpretation, as they are prone to social-desirability bias (Helsper et al., 2021). Performance testing is considered as a more valid way to measure digital skills (Pagani et al., 2016; van Deursen & van Diepen, 2013). Such tests consist of tasks that require participants to perform an activity or construct a response (Claro et al., 2012), thereby offering closer approximations of digital skill levels (Aesaert & van Braak, 2015). While performance testing is more common in controlled educational settings (Aesaert et al., 2014; Alkan & Meinck, 2016; Huggins et al., 2014), the number of studies that apply this method is relatively rare.

Existing performance tests have focused mainly on dimensions such as information search or evaluation (e.g., Bilal & Gwizdka, 2018; Frerejean et al., 2019; Kaarakainen et al., 2019; Nygren & Guath, 2019) and extended perspectives on assessments of digital skills as a broader concept are lacking (Helsper et al., 2021; Siddiq et al., 2016). Additionally, studies using a task-based approach are often conducted on a small scale and cross-country comparisons are missing (Siddiq et al., 2016). Such comparisons provide a more robust basis for analysis and are essential to generalise conclusions (Gui & Argentin, 2011). To address this gap, research needs to critically reflect on performance testing as a method to measure a broad range of digital skills across various countries. This article aims to answer the following research question: What are suitable performance tests for obtaining an in-depth understanding of children's digital skills (referring to information navigation and processing, communication and interaction, and content creation and production) across different countries?

The purpose of this study is to develop performance tests that can be implemented across European countries, facilitating cross-country comparisons. Data from these comparisons on digital skill levels are valuable to inform policymaking at both European and national levels, allowing for targeted interventions where most needed, and providing indicators of the impact of implemented national policies that promote digital skills. A critical first step toward expanding this type of measurement is to develop performance tests that can be applied internationally. Based on data collected from children aged 12 to 17 years in various European countries, the current contribution examines methodological issues in measuring digital skills through performance testing. The identified issues from all participating countries informed the development of the final performance tests and the lessons learned during the development process provide valuable guidance for future test application. The next section explores the conceptual framework underlying the performance tests, followed by an overview of existing digital skills measures.

2. Theoretical Background

2.1. Digital Skills Conceptualisation

The development of performance tests was primarily guided by the youth Digital Skills Indicator (yDSI; Helsper et al., 2021) that proposes four digital skills dimensions: (a) technical and operational skills; (b) information navigation and processing skills; (c) communication and interaction skills; and (d) content creation and production skills. The yDSI conceptualises both functional and critical aspects for each dimension. Functional aspects refer to the ability to use ICT functionalities, while critical aspects focus on understanding how and why content is produced in certain ways and what its impact might be. The measures for the four digital skills dimensions are grounded in a comprehensive review of both academic and grey literature that report on survey and performance test measures. The work of Haddon et al. (2020) and Cortesi et al. (2020) served as the basis for this review.

In the current contribution, the focus is on information navigation and processing, communication and interaction, and content creation and production skills. The tasks do not address technical skills directly as these are implicitly necessary to perform the other skills tasks. Information navigation and processing skills include navigation (e.g., searching information), interpretation (e.g., selecting information), and evaluation (e.g., verifying trustworthiness). Communication and interaction skills include affordances (referring to the design and features of digital technologies, such as managing contacts), privacy (sharing information of self and others), and netiquette (understanding normative and non-discriminative behaviour). Content creation and production skills are conceptualised through affordances (e.g., using multimodality, which involves integrating elements like audio, images, and video to enhance user engagement), content quality (e.g., attracting attention), and ownership (e.g., intellectual property).

2.2. Indirect Measurements of Digital Skills

A considerable body of work relies on surveys to measure digital skills. One widely applied method involves asking respondents which online activities they have engaged in (van Dijk & van Deursen, 2014). While such proxies of usage are correlated with digital skills, they do not measure them directly (Helsper & van Deursen, 2018). The limitation is that undertaking an activity (or not) does not mean that someone has (or lacks) the required skills (Haddon et al., 2020). Furthermore, accurately recalling the frequency of specific activities can be challenging. Another commonly used method is to measure respondents' self-efficacy (Aesaert & van Braak, 2014) that gives an estimation of how proficient people think they are in various skills (Aesaert et al., 2017). Consequently, this approach measures an individual's confidence in their skills rather than actual skills.

Self-assessments in surveys are the most used method to measure digital skills (Allmann & Blank, 2021). This method is relatively straightforward and allows for the inclusion of many questions covering a wide range of skills. Combined with the ease of scoring, this approach facilitates large-scale, cross-national research. A disadvantage is that people struggle to accurately assess their own performance. Personal expectations of a satisfactory skill level and the reference group they compare themselves to influence their assessments (Talja, 2005). Consequently, such measures are sensitive to interpretation and judgment. Another disadvantage is the susceptible to social desirability bias where people tend to present themselves in a favourable manner relative to perceived social norms (King & Bruner, 2000). Specific demographic groups,

such as men and younger individuals, are more likely to overestimate their skill levels compared to objective assessments (Aesaert et al., 2017; Palczyńska & Rynko, 2021; Porat et al., 2018). Consequently, conclusions drawn from self-assessments may suffer from severe validity problems.

2.3. Direct Measurement of Digital Skills

Performance testing is a time- and labour-intensive process that relies on task completion to demonstrate skill levels. Assessments are based on directly observable performance, providing more reliable reflections of an individual's skill level (Jin et al., 2020). Scholars gather data on people's digital skills by analysing observable behaviour, such as task performance that require specific information (e.g., choosing key words) or strategies (e.g., using advanced search settings). Performance testing is, for instance, a widely used method for assessing online reading skills (see for example Castek et al., 2011; Coiro, 2011; Kiili & Leu, 2019). To some extent, approaches to test reading skills share similarities with assessments of information navigation and processing skills, as they focus on tasks aimed at measuring people's ability to locate, evaluate, and synthesize information online. However, tasks that assess skills related to social interaction and content creation and production skills, remain largely absent.

Existing studies have developed several types of performance tests. Some employ constrained response formats where participants interact with a test environment and select correct answers from provided options (e.g., Claro et al., 2012; Hatlevik & Christophersen, 2013). Others use software simulations of real-life ICT applications within a controlled environment where participants demonstrate their skills through simulation-based tasks (e.g., Fraillon & Ainley, 2010; Siddiq et al., 2017). However, biases may arise from participant's familiarity with the software (Fraillon, 2018). Additionally, designers face decisions about which aspects to simulate and which to omit (Engelhardt et al., 2021). Furthermore, these tests often involve a few relatively large tasks, where the testing situation can have a large impact on performance (Jin et al., 2020). Assessments employing interactive standardised tests offer insights into specific skill challenges contrasting with, for instance, multiple-choice tests which are more related to knowledge.

Another type of performance testing involves participants engaging in real-life tasks within an open internet environment observed by researchers (e.g., Eshet-Alkali & Amichai-Hamburger, 2004; Litt, 2013). Participants apply skills to real-life situations and develop their own responses rather than selecting predetermined answers. The results provide insight into the specific skill problems experienced in authentic settings (Frerejean et al., 2019). Challenges include measuring multiple skills in a single test, devising tasks that are applicable across different countries, and developing a systematic coding scheme (Aesaert et al., 2014; Gui & Argentin, 2011). Although there is opportunity for in-depth measurement, their limited availability suggests that their full potential has yet to be realised (Siddiq et al., 2016). Details on the design, implementation, and analysis can serve as valuable guidance for future performance tests, enriching the existing literature on digital skills measurements.

3. Method

3.1. Instrument Design

This article describes the development of performance tests to measure different dimensions of digital skills of children aged 12 to 17 years. Based on the detailed yDSI skill specifications, an initial version of performance

tests featuring real-life tasks was developed. The choice of real-life tasks offered the advantage of allowing children to apply their digital skills in a realistic context. The task creation process was iterative, incorporating regular feedback from the research team and country partners involved in data collection. All children received the same set of tasks. Cognitive interviews and a pilot study were conducted to refine the test and make sure the tasks were age appropriate.

First, cognitive interviews were conducted with five children in the Netherlands and five children in the UK. Children were 12, 14, and 16 years old. A cognitive interview is a qualitative research method used to explore how people think and process information when answering questions or completing tasks (Willis, 2005). Children's feedback provided insights into the comprehensibility and difficulty of tasks for children across different ages and countries. Second, a pilot study involved 143 children from Estonia, Portugal, Belgium, and the Netherlands (see Table 1). For validity purposes, the selected sample was designed for diversity in gender and age groups. Estonia and Portugal held three classroom sessions within one school; Estonia sampled 6th grade children (mostly 12-year-olds), 8th grade children (mostly 14-year-olds), and 10th grade children (mostly 16-year-olds). The sample of Portugal consisted of 8th grade children (aged 12–13), 9th grade children (aged 14–15), and 12th grade children (aged 16–17). Belgium and the Netherlands together held 34 individual sessions. Upon completion of the cognitive interviews and pilot study, the instrument was evaluated carefully, leading to the final performance tests.

Table 1. Sample of the pilot study.

		Estonia		Portugal		Belgium/ The Netherlands		Total	
		N	%	*N*	%	*N*	%	*N*	%
Gender	Boy	31	53	22	43	13	38	66	46
	Girl	25	43	29	57	21	62	75	52
	Other	2	3	0	0	0	0	2	1
Age	12–13	17	29	16	31	1	3	34	24
	14–15	23	40	17	33	10	29	50	35
	16–17	18	31	18	35	23	68	59	41
	N total	58		51		34		143	

Note: Percentages do not add up to 100% due to rounding.

3.2. Procedure

The pilot study of the performance tests was conducted in November 2020 in Estonia, Portugal, Belgium, and the Netherlands. Before starting the test, informed consent was obtained from all children and their caregivers. The test started with demographic questions followed by skill items (yDSI), which took approximately five minutes to complete in all countries. The tasks were performed on a computer or laptop with internet access and a program for creating slides (e.g., PowerPoint), and the test took approximately 50 to 60 minutes.

Due to the Covid-19 pandemic, conducting performance tests in schools was not feasible in some countries. In such cases, tests were conducted individually at home, with the child monitored by a researcher via a video conferencing program that allowed screen sharing and recording. The researcher provided verbal instruction about the procedure and stayed connected with the child throughout the session, using a form to

directly score several task performance indicators. In the classroom setting, children completed the test under the supervision of a teacher and trained researchers. A classroom was prepared to accommodate 15 to 20 children simultaneously, with necessary software for screen recording and slide creation pre-installed on the computers. Scoring was performed afterwards based on video recordings and the schools were not informed about the specific content of the performance tests to prevent teachers from instructing children on specific digital skills before the testing.

3.3. The Pilot Performance Tests

The development of the pilot performance tests was informed by the yDSI, an extensively cross-nationally validated survey measurement. To ensure the tests' validity, we conducted consultations with experts (face validity), cognitive interviews (content validity), and pilot surveys (construct validity) with young people across various European countries. The survey items demonstrated both convergent and discriminant validity, indicating that the four skill dimensions are clearly distinct from one another and measure variety within each dimension. The content of the survey items was carefully converted into tasks to make sure the performance tests also effectively differentiate digital skills levels.

3.3.1. Information Navigation and Processing: Navigation, Interpretation, and Evaluation

The first part of the pilot tests involved four information navigation tasks focused on fact-based searches related to Netflix and dinosaurs that served to test the ability of children to search and select digital sources of information. Children were asked to use the internet and start their search by using a search engine of their choice. The following aspects were coded: (a) the keywords used, (b) the number of search attempts, (c) whether an evaluation of the answer occurred, and (d) whether the correct answer was found. The assessment was based on whether a correct answer was given. Additionally, children were asked to narrow their search to news articles within a designated timeframe, and the coding process verified whether this specification was implemented.

In the second part, four social media posts in the categories of advertisement, phishing, news, and fake news were presented. This task relates to critical processing and evaluation of digital information sources, which required verifying the trustworthiness of information online. After each post, an open question was asked about its purpose. The coding scheme evaluated whether participants correctly identified the intent behind each post (commercial, scam, news, fake news).

3.3.2. Communication and Interaction: Affordances, Privacy, and Netiquette

In the third part, children encountered a scenario where they received a message from an unfamiliar person inviting them to a party and requesting a photo. After the message, an open-ended question prompted children to consider how they would react. This task relates to affordances and tests the ability to react to unwanted online contact. The coding was based on whether the child would share a photo and the reasons behind their decision. Furthermore, children were presented two social media posts: The first showed a publicly shared telephone number, and the second a bikini photo shared only with friends. This task relates to online privacy and evaluates the child's awareness of appropriate sharing practices. The coding criteria assessed whether each post was considered appropriate considering the provided explanations. Regarding

the bikini photo, children could argue for its appropriateness based on it being shared only with friends or its inappropriateness, even among friends, due to its revealing nature.

In the fourth part, children were presented with two WhatsApp conversations about climate change. This task relates to netiquette and involves the critical evaluation of how interpersonal mediated communication affects others. In each chat, one person denies climate change, and the other supported its existence. In the second chat, the person who is arguing that climate change is an issue becomes insulting. After both chat screens, an open question prompted children to identify any problematic aspects in the conversation. The coding scheme scored whether the chat was deemed problematic as well as the accompanying explanations. Only the second chat conversation with aggressive elements should have been considered problematic.

3.3.3. Content Creation and Production: Affordances, Content Quality, and Ownership

The fifth part involved five tasks about content creation and production with the first task centring on strategies to make a GIF go viral when shared online with a broader audience. This task relates to content quality and tests the ability to attract attention and generate impact online. Successful strategies included using hashtags, sharing with friends, and requesting reposts. The second task focused on alternative ways of sharing a presentation beyond email, with correct answers involving programs for file sharing and cloud computing. In the third task, children were asked to improve a presentation slide. Examples of correct improvements were changing font type, reducing the amount of text, using colours, and adding visuals. In the fourth task, children were instructed to create and upload a new slide featuring an animal video. They were provided a link to a website offering free-to-use videos for both commercial and personal use. The task was scored based on their ability to (a) create a new slide, (b) insert an animal video, and (c) save and upload the file. The third and fourth task related to affordances and testing the ability to use multimodality. The final task involved selecting a copyright-free image containing a polar bear and melting ice. This task relates to ownership and tests the ability to use online content covered by copyright. The scoring was based on whether a copyright-free image was uploaded.

3.4. The Final Performance Tests

After carefully addressing the issues identified in the initial performance tests, an enhanced and final version was developed where two more general changes were implemented. First, the test was divided into two modules: The first focuses on information navigation and processing skills and content creation skills, and the second module focuses on communication and interaction skills. Second, there was a more balanced distribution of skills tasks. In the pilot, a relatively large amount of time was spent on information navigation and processing skills and on content creation skills. The number of similar tasks was reduced, allowing the inclusion of skill indicators not fully covered in the pilot.

The validation procedure included feedback from the research team and scholars from six country partners (Estonia, Finland, Germany, Italy, Poland, and Portugal). The final sample included countries that rank high, medium, and low on the Digital Economy and Society Index which is used by the European Commission to assess and compare the digital performance of European Union countries. Pilot testing involved small groups of two to three children in each country. The final performance test instrument is presented in the Supplementary File. The next section outlines specific adjustments made to the pilot test.

3.4.1. Module 1: Information Navigation and Processing Skills

Changes were made to information navigation and processing skills by focusing all tasks on Greta Thunberg. The overarching theme of climate change was chosen for the entire test, reflecting its widespread discussion in schools across all participating countries. In the pilot test, the topic of Netflix turned out to be too centred on native English-speakers, given the varying availability of information across countries where the service is used which meant that this was more a test of comfort with the English language than of information navigation and evaluation skills. Furthermore, a more straightforward coding process was implemented to make cross-national comparisons easier. For example, in the final test, children list the search queries they use for each search attempt. For the same reason, multiple-choice options were added for some questions (e.g., the initial open question about the purpose of posts now includes predefined answer options). Answer options are also provided for the task in which children account for a specific time range in their search.

Furthermore, to ensure all skill indicators of the yDSI received adequate attention, tasks were simplified, and new skill indicators related to evaluation were incorporated. In the final test, children indicate which website they used to find the answer, select the most reliable website from a list of search results, and select what makes a website trustworthy from provided multiple-choice options. Finally, children are asked which of five existing websites available in all countries in the local language is least likely to provide reliable information about climate change.

3.4.2. Module 1: Content Creation and Production Skills

For content creation and production skills, the slide improvement task changed. In the final test, children are required to create a slide focused on climate change, adhering to specific guidelines: using an image as a template, converting its colour to black and white, adding a title, listing three major causes of climate change in bullet points, and including a pollution-related video. Like in the pilot test, a 15-minute maximum limit was implemented. This restriction, coupled with clear task instructions, aims to provide better guidance to children during the test.

Furthermore, the task related to making content go viral was refined for better alignment with the test's theme and continuity, with the children being asked to share their creation with as many people as possible. Rather than an open-ended question format, the task now presents options and asks to select the two options that make widespread dissemination most likely.

3.4.3. Module 2: Communication and Interaction Skills

Communication and interaction skills involve three parts: (a) receiving and sharing information with others, (b) interacting with others, and (c) intimate conversations with friends. In the first part, children are asked to identify which of four posts should not be shared without permission, aligning better with the test's overall theme and aiming to minimise ambiguity compared to the previous bikini photo task, as children could argue that it was either appropriate because it was only shared with friends or inappropriate since it was too revealing. The task involving a message from an unknown person has been revised to streamline responses and make the task more age appropriate (e.g., younger children do not get invited to parties). Instead of open questions yielding varied answers, children select the two most appropriate steps to take when a discussion turns nasty with sexist comments.

In part two, the task on how to contact friends is extended to better capture yDSI items. Children are now prompted to consider different scenarios—such as discussions with a teacher and classmates, close friends, or an expert—and select the most suitable medium for each. A task about Zoom settings during a session where a teacher is speaking has been introduced, both for the child themselves and others. Finally, a task on contacting an expert about Covid-19 via email is added.

In part three, the WhatsApp conversations changed. The fact that someone was a climate change denier proved to be controversial and was seen as wrong by children and thus confused the results which were supposed to relate to recognizing when someone is bullied online and not the veracity of the content of messages. The new conversations, therefore, focus on a school project. Messages in the conversation are numbered and are referred to in answer options, allowing children to select inappropriate parts or choose the option "none of them," thereby reducing cognitive demand.

4. Findings

This study focuses on developing performance tests that can be applied across various European countries to assess children's digital skills. The results show that our tests effectively differentiate between three dimensions of digital skills: information navigation and processing, communication and interaction, and content creation and production. For example, variations in performance between girls and boys were observed depending on the specific skill assessed. The performance tests are also used as teaching materials in class. The current contribution shows the lessons learned in developing performance tests to measure three dimensions of digital skills in different European countries and can be used to inform future test applications.

4.1. Designing Performance Tests

First, important to emphasise is that technical and operational skills underpin all tasks. Although we designed tasks specifically oriented to information navigation and processing, communication and interaction, or content creation and production skills, all skills are to some extent needed to perform each task. An important lesson learned was the necessity of aligning topics with children's online experiences and lived realities to enhance their motivation to complete the tasks. This study particularly focused on ensuring topics were suitable for a wide age range (12 to 17 years old) across various European countries. Choosing universal themes (e.g., climate change or Covid-19) ensured that search task topics are available internationally and applicable across age groups.

The design of a coding scheme is important to generate comparable results but proved to be a difficult endeavour for performance tests of digital skills. Issues arose in determining how to assess the quality of online search performance. To illustrate, a broad search query does not necessarily yield an incorrect answer, sparking debates over whether it was possible to develop objective criteria (e.g., specific keywords, number of search attempts) for successful task performance. Designing a coding scheme also required balancing the complexity of skill indicators and ease of use, especially for large-scale standardised skills assessments. It is important to allocate sufficient time for thorough training with the research team to ensure consistent understanding and application of the criteria across all evaluations.

This test used general survey software; unlike tests designed in a closed test environment, no technical expertise was needed to develop a platform that simulates real-world ICT applications. A disadvantage of performance tests in an open internet environment is the influence of search engine results on skill-related actions. Search engine results can vary based on personalized algorithms, making it more difficult to ensure consistent and reliable measurement of digital skills across individuals.

Additionally, skills related to specific apps or platforms may not always be transferable; for instance, search result filtering settings vary across search engines. Furthermore, not every participant uses the same apps or platforms, and the popularity of these tools can vary significantly between countries. A lesson learned was to let participants choose their preferred search engine when answering fact-based questions.

Designing tasks for communication and interaction, as well as content creation and production skills, proved challenging due to their context-specific nature and reliance on situational relevance. Context helps to resolve ambiguities and ensure consistent measures, especially in cross-national performance tests. The difficulty lies in how to make it as realistic as possible in an open internet environment without programming a platform or manipulating a social media timeline. A lesson learned was to involve children early in the process and take children's level of understanding and experience as a starting point. For instance, initial chat message designs by researchers did not always reflect typical peer conversations as experienced by the children, highlighting the need for adjustments. Communication skill tasks often result in scenario-based questions to capture the interaction element. Generally, balancing real-life authenticity with research control is inherently challenging when developing performance tests. Tasks completed in an open internet environment are authentic but lack control over the differences in children's internet resources and other confounding factors. Although the developed tasks try to replicate real-life scenarios, their validity depends on whether they are realistic for particular children and countries and well designed by the researchers.

4.2. Implementing Performance Tests

The concept of digital skills is broad, making it challenging to design a test that comprehensively assesses all skill dimensions. Because the administration of tasks takes time, it is not feasible to measure all skill dimensions in one performance test. Additionally, performance testing is cognitively demanding, particularly for children, as sustained attention may diminish if tasks are overly time-consuming. It is important to manage both the complexity and completion time of the test. Tests with no time limits bear the risk that some participants spend too much time on certain tasks. In the current study, performance testing could not take longer than one school hour, limiting how extensively each skill can be measured.

Before implementing performance tests, it is important to hold expert consultations and cognitive interviews with the participant group. Designing information navigation tasks—which we expected to be relatively easy—proved to be difficult because solutions needed to be available in the native language of all participating countries, yet not too easily found in the search results. Various rounds of adjustments were necessary to measure information navigation skills cross-nationally. Expert reviews identified potential weaknesses in task instructions, while cognitive interviews provided insights into children's thought processes. These reviews revealed how children react and reason, improving performance tests. For example, while children understood the purpose of the chat messages, they pointed out that these texts did not reflect how a conversation between peers usually goes. A key lesson was to use cognitive interviews

(in addition to an expert round) to understand task interpretation and the need to conduct these interviews in all countries involved for unique perspectives.

In general, explicit instructions are critical for children, reducing the cognitive load of processing information. A lesson learned was to split two-pronged questions (for example, by letting the child answer first if he or she would send a photo and then asking to provide the explanation). Last, an unforeseen challenge was the quality of internet connections at schools, causing difficulties like uploading presentations, despite the availability of computers with internet access.

4.3. Analysing Performance Tests

Performance testing is time- and labour-intensive resulting in small sample sizes, with one solution being to integrate additional questions and let the participant do some coding. For instance, ask the child to list the search terms used. Although it saves effort and time for the researcher, it is more demanding for the child. To balance this, a combination of open-ended and closed tasks was used.

Coding of the performance tests is also labour-intensive. In tasks related to communication and interaction skills, the correct answers to tasks are often subject to interpretation, underscoring the importance of pretesting performance tests within each participating country. For example, in our study, the participating European countries deemed it correct to have cameras on during online classroom conversations. However, cultural differences might influence this view as turning cameras on could be seen as controversial. Additionally, the "other" option was often selected, indicating a need for more detailed guidelines. Open-ended questions, while adding depth to the test, yielded wide-ranging responses, suggesting extensive testing to anticipate possible answers. A drawback of providing more options is that children might not have considered these options themselves and the test in this format might teach them about these rather than test their existing knowledge. Nevertheless, providing precoded categories appeared valuable when working cross-nationally, though leaving an open category for unexpected answers is also essential.

Finally, tasks should focus on a single action, ensuring dependencies between tasks are minimised. For example, the inability to find a copyright-free image should not prevent participants from doing an uploading task. Another lesson was to restrict the number of coders per country to one or two and ensure that all coders are trained before starting the analysis.

5. Conclusion

Ongoing debates exist about the exact dimensions of digital skills and how they should be measured. Scholars generally agree that digital skills are multidimensional (Jin et al., 2020). However, little is known about how to measure a broader range of digital skills through performance testing, especially in cross-national studies involving children. This study addresses test development and application procedures to improve the performance test quality. By developing and cross-nationally testing compatible tasks, we tackled specific issues in performance test development beyond the known challenges of them being time- and labour-intensive.

Our study expands knowledge on how to design effective performance tests, encouraging other researchers to assess digital skills directly. Carefully designed tests measure the actual behaviours and real-life technology engagement, providing a valid assessment of digital skills free from self-assessment biases (Aesaert & van Braak, 2015; Pagani et al., 2016). These developed tests can be used by other researchers to assess digital skills, covering a broader range of dimensions such as information navigation, communication, and content creation. However, important areas to consider are the constraints of various types of performance tests and the complexity of associated coding and analysis procedures.

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Conflict of Interests

The authors declare no conflict of interests.

Supplementary Material

Supplementary material for this article is available online in the format provided by the author (unedited).

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