Barriers Affecting the Effectiveness of Digital Literacy Training Programs (DLTPs) for Marginalised Populations: A Systematic Literature Review

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Abstract: The governments and private sectors have taken several national or regional digital literacy training programs (DLTPs) to mitigate digital inequalities. However, there are noticeable differences in impact and outcomes produced by programs. Since digital literacy is essential for any technical vocational education and training (TVET), this study explores possible barriers influencing the effectiveness of DLTPs at different level levels. Relevant publications were synthesized and coded using a systematic literature review to link main research findings with specific barrier categories. It was found that at the administrative level, policy planning and administrative designing, whereas at the training level, infrastructure followed by training and pedagogy emerged as the most critical determinants for the effectiveness of DLTPs. At an individual level, lack of family support significantly affects learning behavior. A strategic model for the effective implementation of DLTPs is provided. This study constitutes an essential input for research on the digital literacy training literature providing educators and program stakeholders with a reinforced understanding of various ways to manage DLTPs at different levels. Consequently, it closes some identified knowledge gaps and offers additional insights to improve the DLTPs performance at the community level.

Keywords: Digital literacy, training program, marginalized, systematic literature review, TVET

1.   Introduction

Human lives are becoming more reliant on technology, and as the reliance on the Internet and digital communications grows, the workforces are adapting to meet the changing skill demands. Organizations expect most of their employees to have advanced digital skills in the workplace (Oberländer, Beinicke, and Bipp 2020). Entry-level digital skills include works such as data entry, web-based communications, and research, sending email and chat, etc. The lack of digital skills may alienate an individual from potential vocational opportunities. This has raised severe inequality issues amongst populations who are at the margins, thus reiterating the already existing inequalities (Tewathia, Kamath, and Ilavarasan 2020).

Acquiring new digital skills might be intimidating. Not only is it difficult to know where to begin, but the educational gap has been an impediment for most who lack the financial means to pursue any technical degree. To meet the labour market expectations, Technical Vocational Education and Training (TVET) are important links to provide knowledge and skills related to occupations in various sectors of the economy and society through formal, non-formal, and informal learning methods. Recently, information and communication technologies (ICTs) have been incorporated into the vocational training process to aid in both teaching and learning processes as well as acquainting with the minimal digital skills required to be adaptive to the current developments in the digital society (Khramtsova and Mayboroda 2019) Previous studies have emphasized the importance of digital literacy in the current digital society and thus the need to

include the basic digital literacy skills in the courses running for imparting TVET (Hasmadi bin Hassan 2011; Yadav et al. 2017). Furthermore, it is critical to acknowledge that there is no one-size-fits-all solution. Micro-degrees, or highly specialised digital literacy training programs (DLTPs) in a certain field of study, can assist in bridging this gap.

The governments and private sectors have taken several national and regional policy and program initiatives to design and implement digital literacy policies and initiatives. Supporting digital literacy in the marginalised population is a relevant issue with important implications for TVET practitioners (Matli and Ngoepe 2020). However, successfully realising DLTPs has always remained a challenge. Due to poor management and lack of attention to beneficiary needs, programs fail in rigorous implementation. Several factors such as policy planning, availability of infrastructure and resources, and administrative mobility determine the effectiveness of these skill development programs (Madon et al. 2006). Both developed and developing countries may experience the same design and implementation challenges. Nevertheless, developing countries must deal with additional social inequality complexities such as illiteracy, unemployment, gender discrimination, corruption, and extensive resource shortages that hampers strategic implementation (Avgerou and Madon 2005; Lechman 2015; Rashid 2016).

There are noticeable differences in outcomes produced by DLTPs, and a thorough knowledge of the barriers existing at the multilevel phases of program design and implementation can prove helpful in the identification of effective programs and practices to achieve desired outcomes (Duerden and Witt 2012; Durlak 1998; Flores et al. 2004). Such understanding is vital to develop targeted digital solutions and literacy development programs, especially in the digital social inclusion of marginalised populations. Therefore, this study seeks to answer why, even after the continued efforts of governments and private sectors to mitigate digital inequalities, the results are not very satisfactory. To remedy this problem and to promote digital literacy effectively, the present study focuses on exploring the barriers affecting the design and implementation of DLTPs in the context of TVETs.

1.1   Definition of Digital Literacy

Broadly, digital literacy refers to using information and communications technologies to accomplish tangible, productive outcomes in daily situations (Helsper 2012; Helsper, van Deursen, and Eynon 2015). Digital literacy has initially been a concept from the computer sciences discipline and remains an emerging concept in the current information and communications technology (Alagu and Thanuskodi 2019). There is no single commonly accepted definition of digital literacy in digital literacy training research. Different scholars, acknowledged by variant terminologies, have interpreted it differently. For example, Ilomäki et al. (2016) analysed 76 educational research articles, finding 34 terms to refer to the different digital skills and competencies, each with different interpretations. These include digital literacies, digital competence, new literacy, ICT literacy, and media literacy. According to the definition provided by UNESCO, "Digital literacy is the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital technologies for employment, decent jobs and entrepreneurship. It includes various competencies referred to as computer literacy, ICT literacy, information literacy and media literacy" (Law et al., 2018).

Since the Internet's domestication and newly emerging digital technologies, the complexity of digital activities has expanded even more (Grošelj 2021). According to Helsper (2008), defining digital literacy is difficult since technological, cultural, and sociological environments continually change, determining what, when, and how digital technologies are utilised for professional and personal activities. This poses a severe challenge to curriculum designers, training program designers and teacher educators, who aim to enable their target populations to develop the necessary attitudes and skills to adapt to digital usage and achieve tangible outcomes. For gathering data, conducting assessments, and international comparisons, there is a need for a standard definition of digital literacy that encompasses these concerns.

1.2   Existing Barriers Affecting Interventions in Socially Vulnerable Communities

There is debate over the digital divide between those who are and are not benefiting from ICTs (Hosman and Fife 2008). Many ICT programs fail to have a substantial impact because they focus on technology instead of the relationship between ICTs and development (Richard 2010). Resultantly, ICT programs are usually developed using western approaches and in a vacuum from more remarkable economic, cultural, political, and social transformations in developing countries (Ojo and T. 2007; Sahlfeld 2007). The common ICT4D challenges include language barriers (Pade, Mallinson, and Sewry 2008; Sahlfeld 2007); limited infrastructure and skills (Heeks 2019; Kozma and Vota 2014; Molla 2000; Ollerenshaw, Corbett, and Thompson 2021); high implementation and maintenance costs (Imani et al. 2012; Molla 2000); social and cultural barriers (Imani et al. 2012; Krauss 2009) and community and individual resistance (Matodzi 2006). Lack of solutions such as local language digital interfaces, locally relevant content, digital literacy training, the use of icons and audio excludes a significant fraction of illiterate people (Radovanović et al. 2020).

Moreover, inadequate governmental investments and support impede the development of ICT Centres in remote communities (Imani et al., 2012). According to Cartile (2020), a gap in educational curriculum and a lack of consensus in approaches to learning also emerge as a barrier to the development of digital literacy. According to (Beck, Madon, and Sahay 2004), there is a lack of strategies and commitment to action amongst the 'mediators' such as governmental

agencies, nongovernmental organisations (NGOs), and international agencies. In such conditions, practical social protection policies can encourage millions of disadvantaged people but do little to the most unfortunate (CPRC 2004).

1.3   Aim of the Study

The present study is critical from an academic perspective because past program success research in digital literacy training in TVET literature is sparse. Limited review studies exist on specific digital literacy and training issues. The existing research does not look at barriers found at different program design and implementation levels, i.e., administrative, training, learner, and community levels. This review aims to fill in this gap by answering the following research questions; i) What barriers impede the effectiveness of DLTPs? ii) How and with what strategies do DLTPs enter the framework of marginalised communities to empower them?

The study is organised as follows: Section 2 provides a basic understanding of digital literacy and barriers concerning the training programs. Section 3 explains the systematic literature review methodology, including selecting and evaluating publications. Section 4 presents the review findings. This comprises a thorough examination, categorisation, and synthesis of the identified barriers affecting the effectiveness of DLTPs. Section 5 discusses the results and presents a model for effective programme implementation. Section 6 presents the conclusions.

2.   Methodology

A systematic literature review is a comprehensive examination of "a formulated question that uses systematic and explicit methods to identify, select, and critically appraise relevant research and collect and analyse data from the studies included in the review" (Moher et al. 2015)**.** This method was selected as it enables synthesising scientific literature accurately and reliably. Following established standards for using different databases, the study progressed on a systematic and thorough search for literature.

2.1   Search Strategy

Authors performed the keyword search on five databases- Web of Science, Scopus, Taylor & Francis, Education Research and Information Centre (ERIC) and Science Direct - widely recognised social sciences databases (Chadegani et al. 2017; Gavel and Iselid 2008). Nonetheless, it is difficult to ensure that all available studies are considered (Marcos-Pablos and García-Peñalvo 2018); this potential validity risk was mitigated by not using a single search technique. The keywords were divided into two categories. The first category of keywords included terms related to DLTPs such as "digital literacy program", "digital literacy project", "ICT training", "basic computer training", "computer literacy program", "computer skills training". The second set of keywords included the various aspects related to the program such as "effective", "success", "outcomes", "implement", "monitor", "sustenance". All these keywords were included to yield the best possible results from the DLTP literature. To carry out search queries, authors combined each search term from the first category with each search term from the second category with the help of Boolean operators. The study extracted only those studies with the search mentioned above terms in the title, abstract, and keywords. The authors did not impose any restrictions regarding the time.

2.2   Inclusion and Exclusion Criteria

The study set several criteria to select the most relevant studies. Table 1 and table 2 mention a separate list for exclusion criteria to avoid mixing irrelevant information.

2.3   Study Selection

The authors screened all studies based on their titles and were ruled out if the primary target audience did not include marginalised people. After that, abstracts were filtered to exclude studies that were irrelevant or unable to provide an answer to the RQs. Finally, the full-text reviews included all studies on DLTPs and their practical implementation.

Table 1 - Inclusion criteria for the study

Data type	Inclusion criteria	Reason
Study type	Peer-reviewed	To assure that our results come from high-quality journals
Population	Populations outside mainstream due to gender issues, age, language, geography, education, physical ability or immigration status.	Very few studies relate to the populations excluded from the mainstream. The criterion attempts to fill this gap.
Study type	Both (primary and secondary)	Both sets of studies were deemed relevant to gathering adequate information.

| Setting | Both (rural and urban) | To understand the worldviews, challenges and strategies followed in both the settings as per their development level. This will allow for an accurate interpretation of the research. |
| Focus | DLTPs | To synthesise the literature and explore factors determining the effectiveness of DLTPs. |

Table 2 - Exclusion criteria for the study

Data type	Exclusion criteria	Reason
Study type	Studies focused predominantly on computer science (e.g., programming or technology).	Since the study focuses on basic digital literacy, computer science's programming or technological aspects may deviate from the scope of the study.
Study focus	Studies focused on the design and commercialisation of new technology.	To avoid shifting the primary focus of this study from DLTPs and their effectiveness in the case of marginalised populations.
Setting	Studies focused on training programs conducted in formal institutionalised settings	Several reviews target primary and secondary education students, teachers training programs, nursing staff, and doctors. This criterion attempts to fill this gap.
Training domain	Studies focusing on digital training from the perspective of health conditions associated with older age, e.g., aphasia	This study focuses on basic digital literacy rather than a specific domain like health-oriented digital literacy.
Study type	Newsletters, news releases, excerpts, reports, memoranda, editorials and viewpoints.	To avoid biases of the individual opinions.
Language	Studies not written in English	Lack of understanding of different languages encouraged authors to exclude them.
Duplicate	Duplicated Studies	To avoid replication of work.

2.4 Selection Results

The PRISMA flow diagram in figure 1 summarises the search results and selection process for all studies included for review. The initial keyword search identified 7199 studies on different databases. After removing 5156 duplicate studies, 1628 studies were left for consideration. After checking the studies against the inclusion/exclusion criteria, 56 studies were left to read. Following the suggestions of Bezerra et al. (2014), forward and backwards snowballing identified an additional 30 studies, respectively, bringing the total number of studies included in this SLR to 86.

2.5 Quality Assessment Criteria

Quality assessment allows selecting significant studies fit to answer the research questions. Quality assessment criteria with a "quality score" of "3" are present in Table 3. Studies that met this quality score were included for the review.

Table 3 - Quality assessment criteria

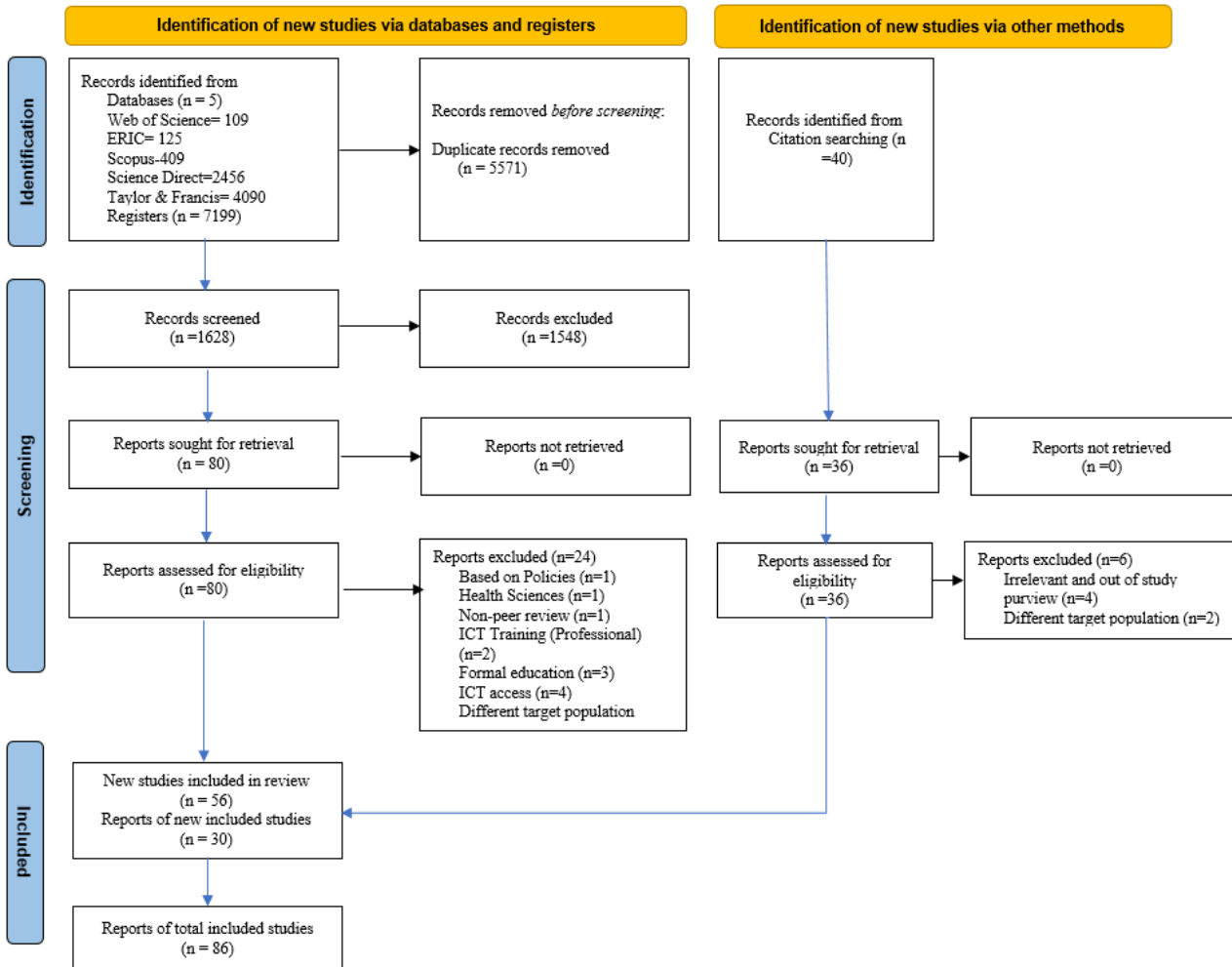|	Criteria	Score
1.	Are the research question/objective/hypothesis mentioned?	If eligible, then Score=1; Otherwise=0
2.	Does the study design mention?	If eligible, then Score=1; Otherwise=0
3.	Does the study meet the inclusion and exclusion criteria set for the study?	If eligible, then Score=1; Otherwise=0

Fig. 1 - PRISMA framework (Adapted-from page et al. (2021)

3. Results

3.1 Study Characteristics

The selected studies demarcate structured and existing research on DLTPs for marginalised populations. The number of publications in this context has increased significantly from only one study in 1986 to 14 studies in 2019. Among the 86 included studies in the sample, 86.05% (74 studies) comprised of articles, 12.79% (11 studies) composed of conference papers and 1.16% (1 study) comprised of book chapters. Concerning the study type, 83.72% (72 studies) constitute primary-data sources, while 16.28% (14 studies) constitute secondary-data resources. The study sample indicates that the leading journal's publication count is educational gerontology (7 studies) regarding top publication outlets. Publishing houses such as Taylor & Francis have published most of the studies (35 studies, 40.7%), Science Direct (11 studies, 12.79%), and Springer (8 studies, 9.3%). In the included studies, the highly cited Studies are: "Who over 65 is online? Elderly's dispositions toward information communication technology", with 309 citations written by Kerryellen Vroman (University of New Hampshire, United States). It is followed by "Digital inclusion projects in developing countries: Processes of institutionalization" with 222 citations written by Shirin Madon (London School of Economics, UK) and "Older adults, computer training, and the systems approach: A formula for success" with 220 citations written by Christopher B. Mayhorn (North Caroline State University, United States).

3.2   Findings

Using the proposed classification framework, we catalogued 80 studies (89.9% of 86 studies reviewed) into four-level categories. Based on our review, we identify four different levels of barriers found at the practical implementation of DLTPs that have received scholarly attention (see Fig. 2).

3.2.1 Barriers Found at The Administrative Level

a) Policy Planning and Designing

Unplanned program policies and initiatives directly impact the implementation process (Martin & Halstead, 2004). Stringent bureaucratic procedures (Garrido, Sullivan, and Gordon 2010), complex user design interface (Martínez-Ballesté, Sebé, and Domingo-Ferrer 2004), and lack of evaluation standard (Razak et al. 2010) hinders the program efficacy. Excessive autonomy provided to the local implementers can also make the process misleading (Madon et al., 2009). The absence of clear guidelines on the role of community and their involvement in training courses hinders program effectiveness (Huggins and Izushi 2002; Razak et al. 2010).

b) Policy Implementation

Lack of cooperative collaboration amongst stakeholders is the primary reason for any program failure. Diverse viewpoints often lead to conflicting goals and representation (Pade-Khene 2018), thus resulting in a lack of administrative responsiveness. Several studies have emphasised the unavailability of funds as a significant reason to produce effective training outcomes (de Brito et al. 2018; Dutta and Mathur 2014; Li-Tsang et al. 2006; Poveda 2018; Rommes, Faulkner, and Van Slooten 2005). Low funds then lead to the lesser geographical coverage of the DLTPs (Poveda 2018). Moreover, the IEC activities are not adequately organised (Chohan and Hu 2020; Madon et al. 2009). Without standardised strategies, all efforts remain inefficacious. Kantamneni and Chintalapati (2013) highlight the demerit of sheer temptation to "get the job done", reflecting the lack of commitment and motivation towards the aspired goals.

c) Monitoring and Evaluation

Studies highlighted several barriers such as difficulty identifying the total cost, lack of uniform evaluation standard, unavailability of local data, a poor mechanism to collect feedback, and lack of strategic indicators (de Brito et al. 2013, 2018; Razak et al. 2010). Other reasons include lack of sufficient resources for evaluation, a lack of evaluation experience inside or outside the program, reservations about the ethics of experimental designs, and general staff opposition to implementing evaluations.

3.2.2 Barriers Found at Training Level

In total, 33 studies (41.25%) referred to administration-related barriers. They are as follows:

a) Training Design

Inadequate training designs wherein lack consideration to minute details such as short-term duration (Mudenda and van Stam 2013), inflexible class timings (Irizarry, Downing, and West 2002), and large class size (Li-Tsang et al. 2006) can significantly reduce the participants' enrolment ratio. Sometimes, the class strength exceeds the available infrastructure or learning space (Li-Tsang et al., 2007). Temporal issues such as non-flexible time arrangements timings (Dlodlo 2009; Umrani and Ghadially 2003) or too strict deadlines to complete the courses create a heavy burden on learners and trainers. Likewise, too flexible deadlines often result in the limited use of available forums (Dlodlo 2009). Besides timings, running mixed-sex training programs can affect female enrolments, as identified by Rommes et al. (2005). However, this is nugatory if inadequate consideration is given to social skills needed for entering labour (Mariscal, Botelho, and Gutiérrez 2008). In addition, participants in DLTPs have a variety of profiles in terms of geographic differences, age, income, education, and other factors, which makes it challenging to conduct training (de Brito et al. 2013).

b) Curriculum

The poorly designed curriculum, which does not meet the learners needs, women learners to be more specific, is one of the barriers identified in studies (Gatti, Brivio, and Galimberti 2017; Lee 2004; Razak et al. 2010). Moreover, studies found that wrong or outdated content (Themistocleous et al. 2010) and lacking in local relevance (de Brito et al. 2013; Poveda 2018; Rabayah 2008; Roman and Colle 2003) negatively affects program popularity. Giving excessive emphasis on hardware rather than the software aspects is again a demerit (Seo et al. 2019)

c) Training and Pedagogy

Learners at the beginner level require special attention and support (Themistocleous et al., 2010). Nevertheless, the autocratic nature of managers at the training centre creates a discouraging teaching-learning environment (Martin and Halstead 2004). The review explored that finding the right candidate to recruit is challenging, affecting quality training at these centres (Raghavendra et al. 2015; Razak et al. 2010).

Trainer's characteristics like low education, lousy personality, lack of teaching experience, lack of expertise to support DLTPs (Huerta and Sandoval-Almazán 2007; Jimoyiannis and Gravani 2010; Razak et al. 2010) has a poor impact on the program efficacy. The trainer's lack of motivation or inclination towards earning rather than developing

literacy skills is another factor (Madon et al. 2009). Moreover, the use of complex terminologies during lectures drives away learning enthusiasm (Themistocleous et al.,2010).

Besides instruction, an unfavourable learning environment affects the learning outcomes. For instance, ethnic minority trainees, immigrants or refugees feel neglected or ignored (Rommes et al. 2005). Lack of continued training and support for the learners, due to which they may lack a sense of affinity (Arthanat et al., 2019; Rikard, Berkowsky, and Cotten 2018). Of course, there is no one-size-fits-all learning environment. What makes teaching so exciting is that there are an infinite number of possible learning contexts.

d) Infrastructural Issues

Lack of Infrastructure is a severe problem, especially in developing countries (de Brito et al. 2018; Li-Tsang et al. 2007; Ogbonnaya-Ogburu, Toyama, and Dillahunt 2019; Raghavendra et al. 2015; Razak et al. 2010). Even if the infrastructure is established somehow, there are scarce and outdated computers, primarily poor quality (Ashraf, Hanisch, and Swatman 2009; Ogbonnaya-Ogburu et al. 2019; Radovanović et al. 2020). Gatti et al. (2017) pointed out how differences exist between available operating devices used in the classroom and the one an individual generally owns. Nevertheless, Dlodlo (2009) accentuated the reason behind infrastructural issues as the most expensive and high-cost devices.

In addition to the above, there is a lack of resources (Li-Tsang et al., 2007; Mudenda and van Stam, 2013). Poor internet connection as a barrier is highlighted in multiple studies (Dutta and Mathur 2014; Huerta and Sandoval-Almazán 2007; Kantamneni and Chintalapati 2013; Ogbonnaya-Ogburu et al. 2019; Poveda 2018; Vong et al. 2017). Moreover, inadequate geographical coverage or a large gap between rural and urban areas makes the training centres inaccessible and affects the impact outcomes of training interventions (Poveda 2018). Individuals, especially the elderly willing to develop digital literacy, may not participate in DLTPs because of far-located training centres (Irizarry et al. 2002).

3.2.3 Barriers Found at Learner Level

a) Motivation and Perceptions

Extant research suggests that personal or psychological factors can significantly affect learning behaviour and eventually impacts the effectiveness of DLTPs. Studies have determined that lack of motivation to learn or shift to online working modes is a significant barrier (Arthanat, Vroman, and Lysack 2016; Rikard et al. 2018; Roman and Colle 2003). In the case of women, they tend to have low priority over the education of other members of their family (Umrani and Ghadially 2003).

Some studies have captured the negative perception of people towards ICTs as one reason DLTPs fail to seek enough enrolment (Ogbonnaya-Ogburu et al., 2019). The reasons for such negative perceptions may vary from person to person. These reasons included low perceived usefulness (Berkowsky et al. 2013; Poveda 2018), lack of trust (Chohan and Hu 2020) and fear of making mistakes (Gatti et al. 2017). Additionally, on an individual level, a few scholars have specified technophobia as one reason for not switching to using ICTs (Arthanat et al. 2016; Chohan and Hu 2020; Dutta and Mathur 2014; Ogbonnaya-Ogburu et al. 2019; Rabayah 2008). The embarrassment further reiterates this over a lack of digital self-efficacy (Kuo et al. 2013; Rikard et al. 2018), inconsistent knowledge base (Gatti et al. 2017; Mayhorn et al. 2004), lack of confidence (Ogbonnaya-Ogburu et al. 2019; Rommes et al. 2005), lack of self-esteem (Khan and Ghadially 2009; Rommes et al. 2005) and lack of time (Poveda 2018). Moreover, in specific populations like the elderly or differently abled, some common challenges include mechanical troubles in holding or positioning the mouse (Martínez-Ballesté et al. 2004), slow typing (Meethongjan & Tachpetpaiboon 2015).

b) Family Support

The cultural or environmental orientation of the learners may either help or hinder their ability to learn (Hofstede 1986). For instance, lack of family support impedes the development of digital literacy skills (Faheem et al. 2018; Jimoyiannis and Gravani 2010; Nedungadi et al. 2018; Smith 2015). This may refer to not supporting female education or restricting women's mobility (Ashraf et al., 2009). This highlights the prevalence of patriarchal beliefs and practices. Furthermore, male Internet users outnumber female Internet users in every country (International Telecommunication Union 2019).

c) Socio-Economic and Demographic Factors

Prior digital literacy training literature has examined the learner's socio-economic and demographic factors that influence digital learning behaviours and found that different populations have different experiences. For instance, in the case of older people, cognitive decline is average, and so they may face difficulties in learning new apps, memorising information (Arthanat 2021; Mayhorn et al. 2004), requiring longer learning time (Berkowsky et al. 2013), and may have a problem in language learning (Garrido et al. 2010). These experiences make their learning more challenging and fuller of struggles (Tsai, Shillair, and Cotten 2017). Sometimes, health-related problems may emerge, such as declining dexterity or visual ability (Berkowsky et al., 2013), slow interactions, and poor hearing (Meethongjan and Tachpetpaiboon 2015). In the

case of other populations, the connection between digital training and social exclusion is especially pronounced among those people who are unemployed, uneducated, elderly, and those with low income (Berger and Croll 2012; de Brito et al. 2013; Garrido et al. 2010; Rabayah 2008; Umrani and Ghadially 2003). The financial situation can have a range of implications on a learner's ability to learn. Learners from wealthy homes are more likely to have a positive educational experience and receive assistance. In contrast, low-income families are less likely to receive such aid, negatively influencing their learning capacities (Chen and Li 2021). According to Seo et al. (2019), more digital literacy training is required for older and low-income vulnerable since they have lower technology access and usage levels than comparable age cohorts of other social and income groups. This is also supported by Sayed and Weber (2015). Further, (Martin & Halstead, 2004) highlighted that the previous unfavorable education experiences might also affect understanding during training. Moreover, lack of knowledge of the English language serves as a big challenge (Dlodlo 2009; Huerta and Sandoval-Almazán 2007; Irizarry et al. 2002; Khan and Ghadially 2009; Li-Tsang et al. 2007). Likewise, (Ogbonnaya-Ogburu et al. 2019) highlighted the lack of possibilities to use ICT at home, at work, or in other settings.

3.2.4 Barriers at The Community Level

Informal community engagement, which involves daily interactions between program supervisors, local officials, and between instructors and localities, affects local program implementation and policy growth. However, other barriers include lack of support from the local governmental bodies (Madon et al. 2009), failure to create and consolidate alliances with key community actors (Mariscal, Botelho, and Gutierrez 2009) and lack of expertise to engage the larger community (Kantamneni and Chintalapati 2013). If the population targeted for the program does not support it, the program fails to achieve desirable outcomes.

3.3 Synthesis of Results and The Identification of Research Gaps

The review results are synthesized as an overview of barriers in figure 2. Each category of the barrier has a specific reason. Poor policy design, implementation, monitoring, and evaluation are at the root of administrative-level barriers. It is essential to define and identify them to prevent maladministration and political and bureaucratic inertia. Training-level barriers are likely to mismatch between skill-based policy programs' objectives and available training facilities. Learner or community level barriers have an undeniable effect on public policies since these directly impact outcomes produced by policy programs. Each barrier category is a complementary component to each other. Without new policy-level reforms, implementation strategies cannot be successful at training and community levels.

Research gaps include:

First, in education, training, and employment, there is a need to have a reference framework of being digital literate in an increasingly globalised and digital world (Carretero, Vuorikari, and Punie 2017). Frameworks provided by organisations such as European Commission (e.g., Carretero et al., 2017; Vuorikari et al., 2016) and UNESCO (Law et al. 2018) may not serve as a one-size-fits-all framework of digital literacy and to address the intricacies, inadequacies, and research gaps in alignment with the 2030 Agenda for Sustainable Development (Shulla et al. 2020). Thus, the need is to develop and validate digital literacy assessment tools while keeping in mind the different "contexts" and "target populations" (Lyons et al. 2019). More cross-cultural research studies can advance our knowledge beyond our immediate environment, embracing a universal perspective on digital behaviour.

Secondly, studies indicate the need to identify the key performance indicators (KPIs) for developing an effective evaluative mechanism for assessing the sustainability and scalability of DLTPs. The KPIs focus on institutional, individual, or program performance aspects crucial to programs' success (Radovanović et al., 2020).

Third, a shortage of research exists on the individual and community level determinants that affect the program implementation and technology adoption at the grassroots level, specifically in DLTPs. Future studies can further work in this direction.

Fourth, there has been a lack of focus on how information sharing and collaboration between actors might benefit DLTPs. The bottom-up training implementation model (Sabatier 1986) requires further detailed attention. Establishing

these program models is particularly important because it entails several institutional logics and coordination with a wide range of stakeholders.
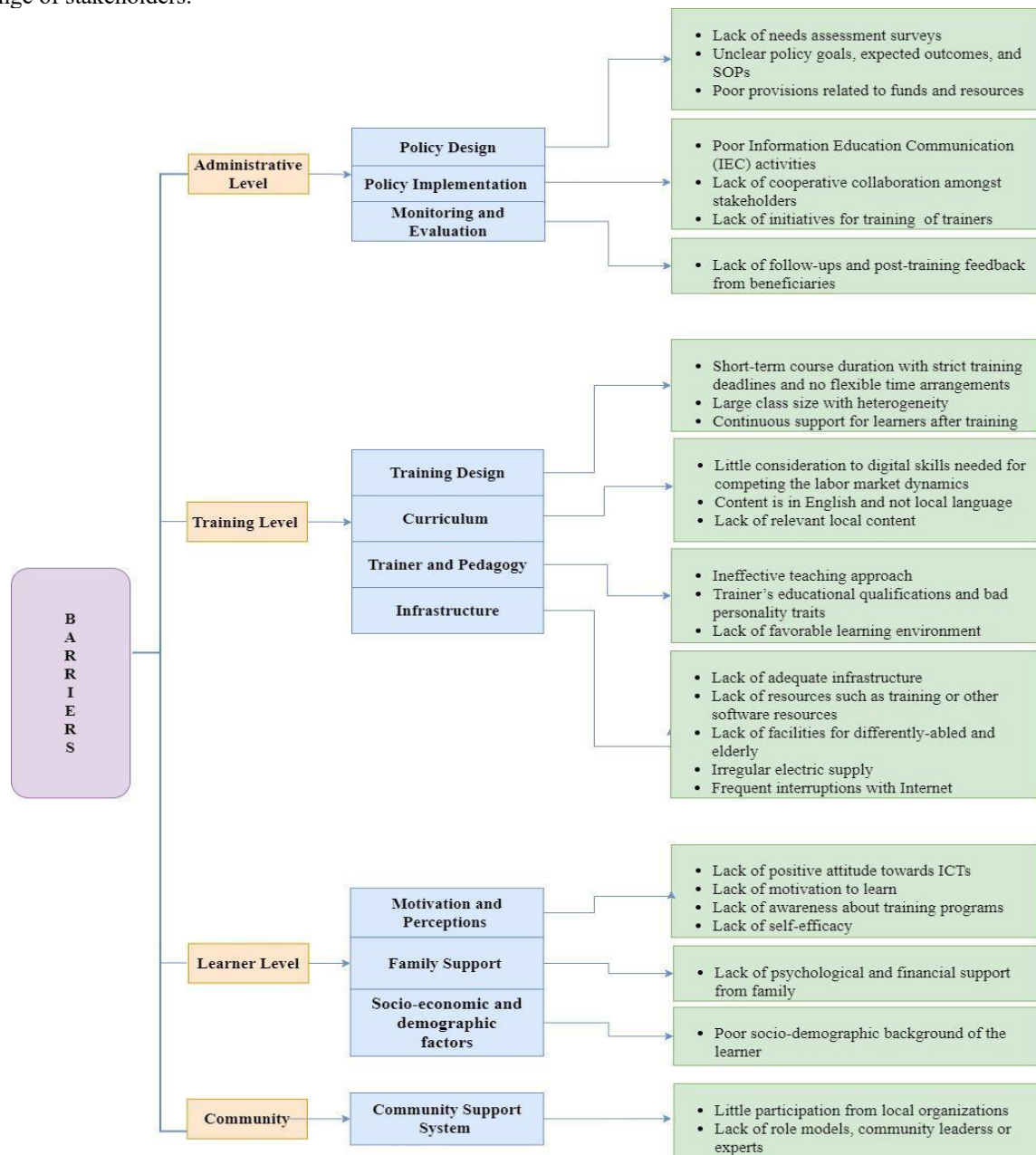

Fig. 2 - Classification of identified barriers

Fifth, there is a lack of studies examining the significance of digital inclusion from the gender perspective. Studies focusing on the intersectional analysis of gender problems can bring more insights.

Sixth, future studies should pay attention to comprehending and developing measures for tangible outcomes of Internet use in the context of marginalised populations. Longitudinal studies can provide insights to observe tangible outcomes at both individual and group levels.

Seventh, training programs developed without training theories are less than optimal (Rogers, Campbell, and Pak 2001). Future researchers can examine DLTPs using solid theoretical underpinnings to derive meaningful interpretations regarding the program effectiveness.

4.   Discussions

The present study explores barriers that affect the effectiveness of DLTPs in communities with high social vulnerability and presents a set of best practices for realising the goals of digital social inclusion and empowerment. The review yielded a wide range of barriers from different levels of program implementation (see Fig. 2). DLTP implementation and developing digital literacy is a management-intensive activity. As introduced in Section 3.3, lack of cooperative

collaboration amongst stakeholders at the implementation level, infrastructural issues at the training level and lack of personal motivation to learn and adopt at the individual level contribute to a program failure.

Changing an individual's way of adapting to digital ways is difficult (Pinder et al., 2018). Governments and administrations at both public and private levels should ensure personal access and adequate training and learning time for beginners to alleviate user resistance. Different people can learn the same curriculum at different learning paces, and therefore, the careful consideration of the needs and personal characteristics of the target populations is a must.

Madon et al. (2009) proposed pilot project strategies for implementing training programs for different populations, depending upon the program level and resources that support the main organisational functions. It can assist the administration in circumventing potential roadblocks and avoiding substantial financial costs if the DLTP implementation fails. It also helps develop a prospective best practice model to assist stakeholders in assessing investment outcomes.

The barriers have intricate interconnections; thus, it is difficult to classify them and conceive them in very different groups. Lack of technical support, time, and training, for example, can cause technical difficulties at teaching levels, leading to a lack of access to ICT resources and a lack of digital competency at the learner level.

By undertaking this literature review, we observed that community-level barriers are less explored. Moreover, future research can explore cultural differences and their influence on the motive pattern in learning and developing digital behaviours. It will provide opportunities for future researchers, especially considering how effective government policies can be implemented while supplementing the adequate infrastructure at the training level.

4.1 Model for effective program implementation

Considering the relevance of digital literacy, we envisage some strategies (see Fig. 3) and considerations that serve as a scaffold for the future design and more effective implementation of DLTPs. The target audiences of the study are encouraged to follow them throughout the different phases of program implementation.
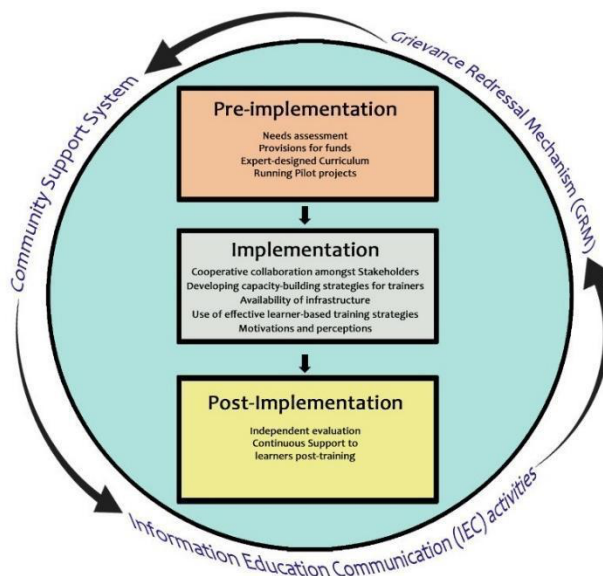

Fig. 3 - Model for effective program implementation

4.1.1 Pre-implementation Phase

a) Need Assessment Surveys

A significant gap still exists between those who design DLTPs and their beneficiaries in terms of the socio-economic, cultural, geographic, and demographic disparities. Policymakers and educators should evaluate the characteristics of the population, attitudes, and beliefs towards ICTs before developing digital inclusion policies and initiatives. Participatory Rural Appraisal (PRA) can be a practical approach to assess public demands and interests. In addition, Doran (1981) introduced the specific, measurable, assignable, realistic, and time-related (SMART) method to set practical program goals. However, they should also delineate different contexts (Bjerke and Renger 2017).

b) Provisions for Funds and Resources

Inadequate facilities, untrained employees, and low compensation can result from a lack of regular and sufficient funding. The stability of a program is greatly influenced by its financial sources and its ability to assist the underprivileged who cannot afford to pay fees. Therefore, there is a need to support community-based skill development programs with

adequate financial and technical assistance. A "funnel analysis" suggested by Bangser (2014) can prove helpful in this case.

c) Expert-Designed Curriculum

The curriculum design must be based on the individual learner's needs. The courses need to be available in regional languages, including the dialects spoken by indigenous people, considering the issues of access, equity, and inclusivity in training programs. It is necessary to incorporate problem-solving or computational thinking skills in the digital literacy courses because understanding the machine learning technological nature of problem-solving with digital technology is becoming increasingly relevant (Law et al., 2018). Special attention to netiquette is required to ensure long-term sustainable and equitable use of digital technology. In digital domains, such advancements sustain and promote values of justice and equity.

e) Running Pilot Projects

The planning and implementation stages of project development are merged with a pilot project's help. It is an excellent technique to educate management and gain project support. It aids in the cost-benefit analysis, allowing comparing and contrasting hardware, software, training design, procedures, and other options.

4.1.2   Implementation Phase

a) Facilitate Cooperation Between Stakeholders

Management should build mechanisms to allow collaboration among stakeholders, such as communities, learners, trainers, universities, the labour market, and governments, to increase the possibility of effective adult education practices and the synergic interactions between these actors. It is advisable to involve program stakeholders early in the process and throughout all phases of the policy program (Titler 2008).

b) Developing Capacity-Building Strategies

Capacity building is a multi-step process that includes value-added education, trainer training, multiplier activities, and networking. It entails both institutional and human capacity development. Trainer training before the program launch and running professional development course during the program's implementation phase(s) help decision-makers, trainers and evaluators identify and eliminate bias in overall training design and course curriculum. 'One size fits all' training is unlikely to be effective (Vroman, Arthanat, and Lysack 2015).

c) Infrastructure

The design of training infrastructure affects learning outcomes. Training centres in marginalised areas face the most considerable investment needs in the country. Moreover, an ad hoc approach to infrastructure investment is problematic. Using open-source software and open learning resources can reduce costs and help address large groups and communities in the local language. This can enhance the program's reachability and contribute to the digital transformation in 'under-connected' areas with low literacy levels (Radovanović et al. 2020).

d) Use of Effective Learner-Based Training Strategies

Adapting learner-centred, collaborative, and gender-responsive teaching pedagogies to teach digital literacy to various target groups is critical, especially for the elderly and differently abled population. Moreover, recruiting and educating more female ICT teachers can benefit women. Thus, program designers should invest in hiring and educating more female teachers in technology-related subjects at all levels of education and up-skilling current female ICT teachers. Besides, microfinance can also facilitate micro solutions to local problems and needs.

e) Motivations and Perceptions

Trainers and learners should understand the significance of developing digital literacy. This will ensure their solid and positive motivations and perceptions throughout the teaching and learning processes. It is equally essential for the staff and other people responsible for implementing DLTPs.

4.1.3   Post-Implementation Phase

a) Independent Evaluation

Evaluation of programs and procedures ensure that they address goals and objectives. If they fail, decision-makers should reinforce or adjust their current policies and procedures or develop new ones to provide sustainable programs or services. A thorough analysis and synthesis of local conditions and applicable lessons learned from evaluations of similar initiatives should be the starting point for developing a solid theory of change (Mahmoud et al. 1978). The design and

implementation of evaluation mechanisms should consider the national context since they help yield relevant and meaningful data (Luo and Liu 2014). Culturally responsive evaluation enhances the quality of assessment while also promoting equity and fairness. Adding to this, King (2021) advocates for theory-based evaluation. The Critical Decision Method (CDM), an incident-based cognitive task analysis technique, can also help experts narrate tales from their field practices and extract lessons (Klein, Calderwood, and Macgregor 1989; Steelman et al. 2016, 2017). This is essential to plan and develop outcome based and cost-effective DLTPs replicable in the community.

b) Continuous Support to Learners Post-Training

Trainees must push themselves to learn new things and develop new ideas and abilities. Learning must be flexible, on-demand, and ongoing to achieve these outcomes. Creating a post-training learning culture is an efficient strategy to increase program outcomes, trainee satisfaction and retention.

4.1.4   During All Phases

a) Robust Collaborative Community Support System

Programs, policies and procedures should merge into the broader community fabric. The strengthened social solidarity networks can address the basic needs of marginalised individuals in local communities. In this, local governments, NGOs, private sectors, local experts and role models can offer collaborative assistance in running awareness campaigns on social issues such as cyber-security, violence against women etc., to raise awareness of the digital inequality in ICT. It is indeed worth looking into the possibility of integrating services into the community infrastructure. Completely integrated programs and services provide more extensive service delivery activities and, as a result, are more likely to be sustained.

b) Information Education Communication (IEC) Activities

The significance of IEC stems from its consultative and specific research on target groups, which allow a better understanding of the wants and requirements. An effective IEC campaign involving public, private and civic organisations must be run for extensive coverage, supplying materials, and training IEC workers. Such campaigns can serve as an essential medium for social transformation and development. The scarcity of resources, unfavourable economic conditions, lack of awareness, and illiteracy makes all these communication efforts unavoidable in these locations.

c) Grievance Redressal Mechanism

A grievance redress mechanism (GRM) established at all phases of program implementation enables to raise issues with the authorities and seek redress. These are useful to provide services satisfactorily. The authorities should attempt to reach out to the complainant and register their complaints. Such grievances serve as an indicator of the work progress over time.

5.   Conclusion and Study Limitation

This systematic review aimed to examine prior literature on the tailoring capabilities and mechanisms of DLTPs designed for marginalised populations. The research study obtained 7199 studies from five different research databases. Application of inclusion and exclusion criteria and a quality assessment to study only relevant works reduced the number of studies to 86. Bridging the digital divide is essential for the long-term viability of digitalized society. Since DLTPs are vital instruments in addressing the digital divide and inclusion issues, governments and other organizations are extending huge support in promoting such programs. Even in TVET, digital literacy has surfaced as a prerequisite and therefore this study is a significant contribution to the literature in informing the educators and program stakeholders with a reinforced understanding of various ways to manage DLTPs at different levels. Consequently, it closes some identified knowledge gaps and offers additional insights to improve the DLTPs performance at the community level.

The study explored the nature of DLTPs, and they different types of barriers impeding the effectiveness of DLTPs. This review will help researchers and decision-makers determine the best mechanism for developing DLTPs. In addition, the barriers discovered may lead to new study avenues. Furthermore, the findings can improve DLTPs that are not delivering concrete results. Future works may apply the learned knowledge to propose new DLTPs that solve the challenges and issues identified through this study. This will include selecting and developing DLTP approaches and classifying marginalised communities to make their teaching and learning processes helpful and effective.

Some limitations should be considered when evaluating the review findings. First, the study results are based on the applied research method, which includes the selection of keywords and databases. The application of the search terms to study titles, abstracts, and keywords limits the scope of the search results. Second, the focus on peer-reviewed journal or conference proceedings publications is also a restriction. Other publications such as books and grey literature that contribute to research could be considered in field-specific reviews. Finally, this study only examined English-language studies, skipping other significant languages such as China, German, French, Spanish and others. This language selection may lead to cultural and other biases.

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