



Review of UDL in Low- and Middle-Income Countries

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Acronyms

CAST	Center for Applied Special Technology
CBID	Community Based Inclusive Development
CBM	Christoffel-Blindenmission Christian Blind Mission e.V.
IDEA	Including Disability in Education in Africa
LMICs	Low- and Middle-Income Countries
NGO	non-governmental organisation
OER	Open Educational Resource
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SDGs	Sustainable Development Goals
UCT	University of Cape Town
UD	Universal Design
UDL	Universal Design for Learning
UN	United Nations
UNCRPD	United Nations Convention on the Rights of Persons with Disabilities
UNDESA	United Nations Department of Economic and Social Affairs
UNESCO	United Nations Educational, Scientific and Cultural Organization

Executive summary

Similar to inclusive education, UDL is often viewed as an approach only for the inclusion of learners with disabilities. However, it is a practice aimed at the inclusion of all learners, irrespective of the kind of barriers to learning that they face. UDL recognises that everyone learns differently and is an instructional strategy that can address systemic inequality and discrimination, which may arise from an intersectionality of multiple forms of disadvantage (e.g. racial inequality, gender discrimination, poverty, disability stigma). UNESCO's *Global Education Monitoring Report 2020* strongly recommends the adoption of UDL at government level so that it becomes an integral part of countries' inclusive education policies.

CBM, while acknowledging the growing importance of UDL as a framework for implementing inclusive education, also recognised that there was minimal evidence and guidance on how it might be effectively implemented in LMICs. Without deeper knowledge of UDL in LMICs, CBM considered its promotion of and training in this approach premature. Consequently, the Including Disability in Education in Africa (IDEA) research unit at the University of Cape Town, South Africa, was commissioned to review current UDL practices, training needs and relevant online resources in LMICs.

Given the gap in research and knowledge of how and where inclusive education is implemented in LMICs, and the extent to which UDL forms part of this implementation, the terms of reference for this research were to review current practices of UDL in LMIC settings with a view to forming recommendations for capacity-development resources and materials. An area identified as particularly important was understanding current teacher training in UDL in order to identify context-relevant capacity-building needs for professional development.

Three strategies were used to gather information on UDL practices in LMICs:

- A scoping review of literature on UDL (journal articles, book chapters, and dissertations) from LMICs, which was conducted in February and March 2021 using various online databases. The literature was reviewed in the form of themes generated through inductive and deductive analysis, and

used to inform subsequent interviews with UDL promoters and practitioners in LMICs.

- A review of OERs on UDL (textual and audio-visual) and their relevance to LMICs was conducted using Google Search. The content of the OERs was further analysed in terms of quality, principles and practices of UDL.
- Online interviews were held with representatives of international agencies, NGOs and UDL experts experienced in providing inclusive education services in LMICs. These interviews were conducted according to an interview schedule to gain a deeper understanding of current UDL initiatives in LMICs that may not yet be reported in the literature. Interviewees were asked about the critical issues and recommendations they might have for the implementation of UDL in LMICs, with a particular focus on capacity building. The interviews were transcribed, coded, analysed and then presented thematically, supported by verbatim quotations from participants.

An interpretive discussion of the findings from the three different sources of data informed the recommendations for UDL practices in LMICs made in this report.

Nine themes were identified from the literature review: capacity building, levels of technology, diversity of target audience, role of communities and families, addressing systemic inequality, policy supporting implementation, disability and UDL, challenges, and the potential impact of UDL. Each theme is discussed in detail in section 2 of this report.

It was found that capacity-building for teachers should include in-service and pre-service teachers, and be mindful that not only are the needs of teachers diverse, but there are also pressing material needs in LMICs that affect the way diversity, disability and difference are understood. Localised understanding of UDL based upon local teaching practice is necessary, which may also help to overcome teacher resistance implementing UDL resulting from already overwhelming daily challenges.

There is a debate about the use of technology and low tech, and locally available resources are suggested for use in LMIC contexts. However, teachers should have the opportunity to develop digital literacy and online skills in order to

support the development of digital literacy in their learners. The role of support from families and communities also requires attention.

While collaboration with educators and researchers from high-income countries with more experience in UDL is a useful strategy, this needs to be seen as an equal partnership rather than a one-way transferral of expertise. Ultimately, UDL can operationalise inclusive education policies, be used as a tool to equalise opportunity, and has the potential to address systemic inequality.

Six themes emerged from the interviews: experience and understanding of UDL, UDL supporting inclusive education, UDL in teacher-training initiatives and capacity building, technology and digital literacy in UDL, UDL and addressing equity issues and discrimination, and challenges and potential of UDL. Each theme is discussed in detail in section 3 of this report.

UDL is seen as a tool to support the achievement of the SDGs in its response to diversity, and answers the call to 'leave no-one behind'. It was agreed that the concept and practice of UDL principles is not unfamiliar, that it enables thinking at a systemic rather than an individual level, and that it helps educators to move from a medical model of disability to a human rights, diversity and inclusion perspective. Importantly, inclusive education and UDL cannot exist independent of each other, with UDL seen as an instructional approach that provides an operational framework to implement flexible teaching in inclusive education.

Another imperative identified was that practical training has to be bolstered by evidence of successful implementation of UDL, and that UDL needs to be included in policy for designing pre-service teacher training, accompanied by a plan and ongoing support approached through a social model lens. As such, the involvement of government authorities and policymakers is crucial for financing and sustaining UDL training programmes. However, although governments indicate interest in UDL, it has not yet reached the point of being an educational priority.

Each of the recommendations presented in this report include a justification and suggestions for how it might be implemented. These are discussed in section 4 of this report.

Ten recommendations were identified:

1. Capacity building for UDL should be grounded in, informed by and adapted to broader educational philosophies and approaches that are relevant to the context of implementation.
2. The implementation of a training programme needs to take into account possible resistance from teachers on the grounds of the material realities of large classrooms and difficult working conditions.
3. Blended course delivery models for teacher education should be developed that balance in-person teaching with online teaching according to the context.
4. There needs to be rigorous research on the impact of teacher education in UDL on the learning outcomes for children.
5. Capacity building should aim to develop not only UDL skills, but also leadership in UDL that supports the empowerment of local educators to adapt and use UDL within their own contexts.
6. Recognition of the importance of assistive technology and reasonable accommodations that will be required for children with disabilities is necessary.
7. Promoting family and community involvement in the implementation of UDL is important.
8. There is a need to explore the power of UDL to address the fault lines of inequality and stigma in the teaching and learning community and to document experiences.
9. Teachers should be empowered to use creative approaches and take control of their own learning and how to present materials and to engage and assess their learners.
10. Teachers should engage with different levels of technology in the implementation of UDL.

1. Introduction

As a major global non-governmental organisation (NGO) working in the field of disability-inclusive development, Christian Blind Mission (CBM) has multiple engagements in inclusive education through its country offices, partner organisations and alliances. In keeping abreast of global trends, CBM acknowledged the growing importance of Universal Design for Learning (UDL) as a framework for implementing inclusive education. However, it also recognised that there was a lack of evidence and little guidance on how UDL might be effectively implemented in low- and middle-income countries (LMICs). It was thus premature for CBM to institute the promotion of and training in this approach without a deeper knowledge of UDL in LMICs. As a result, the Including Disability in Education in Africa (IDEA) research unit at the University of Cape Town (UCT) was commissioned to undertake a review to identify current UDL practices, training needs and relevant online resources in LMICs. The specific terms of reference were to review current practices of UDL in LMIC settings with a view to forming recommendations for capacity-development resources and materials, including: a literature review of the use of UDL in LMICs; exploration of the potential of UDL to address systemic discrimination based on race/ethnicity and disability; compiling relevant online UDL materials that are available into a database; interviewing several key informants; and making recommendations for online learning for UDL in LMICs.

This section provides an overview of the foundations of and relationship between inclusive education and UDL, the research questions that were addressed, and the methodology used.

Inclusive education

Inclusive education is a process of responding to the needs of all learners and removing barriers to participation and inclusion in education. It has commonly been misunderstood as a strategy for including only learners with disabilities, yet at its core is the removal of all forms of barriers that may negatively impact on learners' ability to learn (UNESCO, 2020). Inclusive education moves away from traditional 'special education' and other related approaches that focus on perceived learner deficits and advocate for segregated provision or mainstreaming of a select few who meet certain criteria, to an approach that

recognises that all learners learn differently and that the system has to be changed to fit the learner (Stubbs, 2008). Slee (2018: 8) offers this broad definition:

Inclusive education refers to securing and guaranteeing the right of all children to access, presence, participation and success in their local regular school. Inclusive education calls upon neighbourhood schools to build their capacity to eliminate barriers to access, presence, participation and achievement in order to be able to provide excellent educational experiences and outcomes for all children and young people.

Equitable access to inclusive education is a central pillar of the global development agenda, as evidenced by international agreements and treaties such as The Salamanca Statement and Framework for Action on Special Needs Education (UNESCO, 1994), the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) (UN General Assembly, 2006), and the Sustainable Development Goals (SDGs) (UNDESA, 2015). Article 24 of the UNCRPD indicates that 'States Parties shall ensure an inclusive education system at all levels and lifelong learning...' while the aim of SDG 4 is to 'Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all'. These global frameworks oblige UN member states to introduce policies and practices that promote inclusive education. Consequently, there is the need to consider practices that promote effective inclusive education in LMICs, where school attendance and successful completion is remarkably low compared to the trends in high-income countries, especially among children with disabilities (UNDESA, 2018). For instance, according to the World Bank (2018), less than 10% of all children under the age of 14 with disabilities attend school in Africa. As dire as this situation is, this report is mindful of the need to resist across-the-board application of strategies developed in Western settings to LMICs and rather take context into account in meaningful ways. This is particularly important when 'both research and international discourse on inclusive education remains heavily focused on Western contexts' (Song, 2016: 911). As Grech (2011) has indicated, dominant Western voices and ideologies in the extant inclusive education literature might not be relatable to the needs and material realities of LMICs. Thus, it is necessary to investigate the practice of inclusive education from the perspective of LMICs.

Universal Design for Learning

UDL is increasingly recognised as an effective and viable instructional strategy to achieve inclusive education for all learners from different backgrounds with a diversity of learning support needs. UDL is an approach that addresses barriers to learning by applying three principles that emerged from research on the neurological basis of learning styles conducted by the Center for Applied Special Technology (CAST) in the USA (Rose and Meyer, 2002; CAST, 2018). The three principles are:

- *Multiple means of representation*: Provide multiple, flexible methods of presentation to support different ways of knowledge and information acquisition by learners. The teacher can present, for example, the learning materials through various media (visual, auditory, tactile), and provide multiple examples that can be modified in complexity to meet a range of learning needs.
- *Multiple means of action and expression*: Provide multiple, flexible methods of action and expression through differentiating the ways in which learners can express what they know. The teacher may use strategies that allow learners to practice tasks with different levels of support and to demonstrate their knowledge and skills in a diversity of ways.
- *Multiple means of engagement*: Provide multiple, flexible options for engagement by allowing learners to deepen their engagement and interest in the world around them through an array of learning activities that are accessible to learners with different abilities. This principle involves creating interesting learning opportunities that motivate and stimulate learners according to their personal backgrounds and interests.

These principles are recognised as important in enabling an equal opportunity to learn for all learners in a classroom (UNESCO, 2020).

UDL and inclusive education

Similar to inclusive education, UDL is often viewed as an approach only for the inclusion of learners with disabilities. However, it is a practice aimed at the inclusion of all learners, irrespective of whether they face barriers to learning. It uses the three principles to make learning and teaching accessible to the greatest possible range of diversity, rather than catering for the non-existent

'average learner' (Baglieri, et al., 2011). UDL recognises that everyone learns differently and is an instructional strategy that can address systemic inequality and discrimination, which may arise from an intersectionality of a diverse range of disadvantages (e.g. racial inequality, gender, socio-economic background, disability) (Rose and Meyer, 2002). UNESCO's *Global Education Monitoring Report 2020* strongly recommends the adoption of UDL at government level so that it becomes an integral part of countries' inclusive education policies. To achieve this, an important initial step is to explore current inclusive-education practices and how UDL fits into these.

Review of UDL in LMICs

This report was commissioned by CBM to review the current practice of UDL in LMICs. Given the gap in research and knowledge of how and where inclusive education is implemented in LMICs, and the extent to which UDL forms part of this implementation, the purpose of the research was to gather evidence to inform the development of capacity-building resources and materials for UDL in LMICs. An area identified as particularly important was understanding current teacher training in UDL in order to identify context-relevant capacity-building needs for professional development. Three strategies were used to gather information to gain an overview of the practices:

- *Scoping review of literature on UDL from LMICs.* This involved searching for published literature sources on UDL practices from all LMIC contexts. The literature (journal articles, book chapters, and dissertations) was searched for between February and March 2021 on online databases. This literature was analysed thematically and the findings presented in the literature review section of this report.
- *Review of open educational resources (OERs) on UDL and their relevance to the LMIC setting.* This involved searching for open online textual and audio-visual resources on UDL principles, practices and training. OERs were analysed for their relevance to LMIC settings by considering direct references to LMICs and accessibility in terms of level of technology needed and language (e.g. the presence/absence of captions in videos).
- *Online interviews with representatives of international agencies, NGOs and UDL experts who have experience in providing inclusive-education services in LMICs.* The interviews sought participants' experiences of UDL and their

perceptions of UDL as an approach to promote inclusive education in LMIC settings. Four interviews were with individuals, two interviews were with two participants each, and one was a focus group interview with four participants. The data from the interviews were analysed thematically.

The following sections present:

- the findings of the scoping review in the form of themes generated through a combination of inductive and deductive analysis of the literature
- a thematic analysis of interviews through descriptive presentation of the themes, supported by verbatim quotations from participants
- an interpretive discussion of the findings from the three different sources of data and, derived from these findings, recommendations for UDL practice in LMICs.

The appendices include the search terms for the scoping review, a summary of the reviewed online open sources on UDL, and the interview schedule.

2. Literature review

A scoping review of the literature was conducted for evidence of current UDL practices in LMICs written in English. The purpose of this review was to understand existing research and current gaps, as well as inform subsequent interviews with UDL promoters and practitioners in LMICs.

Review method

With the guidance of a subject librarian at the University of Cape Town, articles were selected through searches of the following electronic databases:

EBSCOhost (Academic Search Premier, Africa-Wide Information, ERIC, MasterFILE Premier), PubMed, Scopus, Web of Science, and Google Scholar.

The search string combined the key search terms 'universal design for learning' and 'low middle income countr*' and their alternative terms using Boolean logic (Appendix 1). One author conducted the literature search, but all of the authors screened the titles, abstracts and full-text articles, and met to discuss and reach consensus at every level of screening. The selection criteria used were that the paper had to be about UDL policy, research or practice in a LMIC setting,

including reviews of UDL practices and challenges in LMICs. Figure 1 indicates the process of article selection through a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) chart (Moher, 2009).

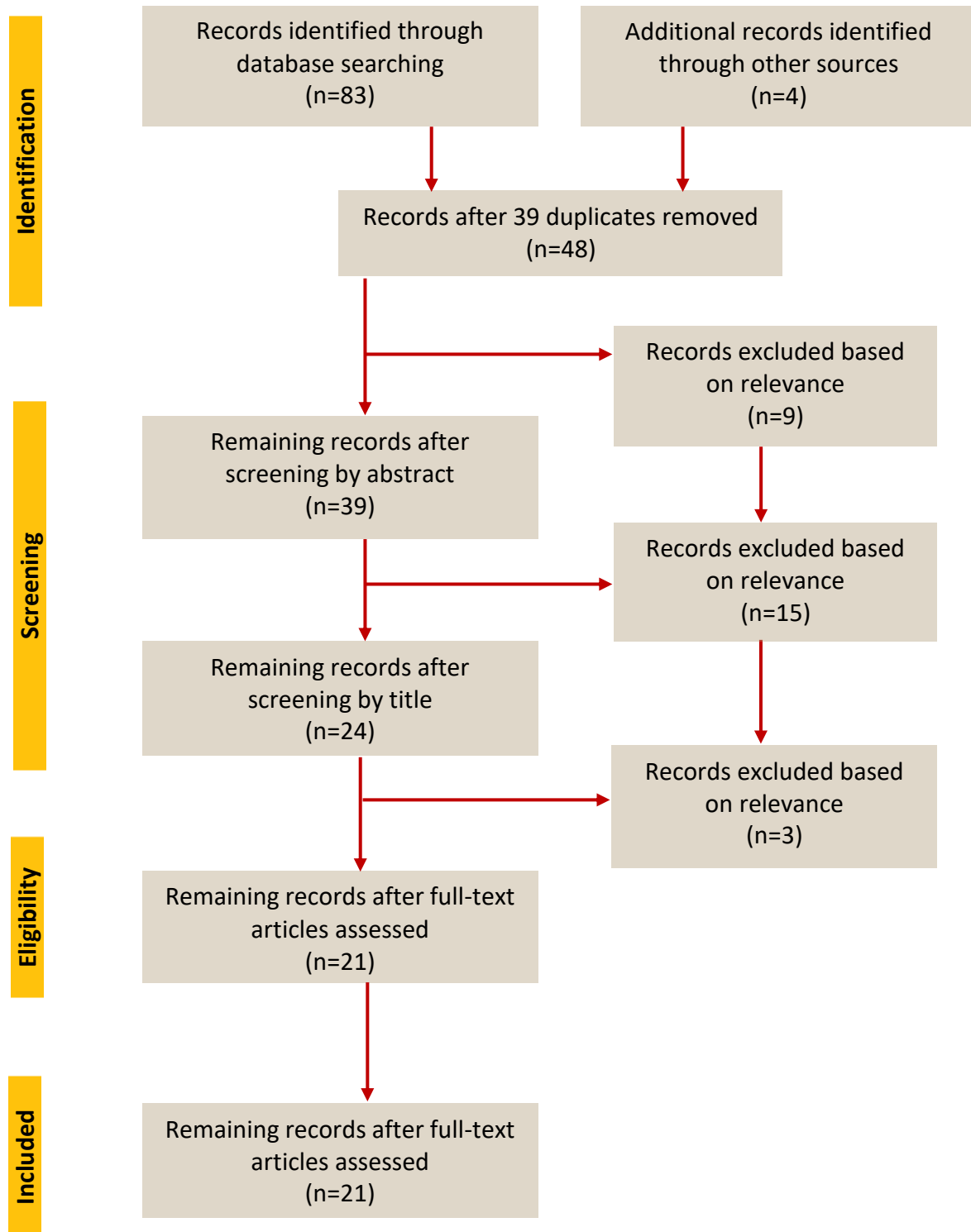


Figure 1: Article selection process

Analysis of the literature

Twenty-one articles were included in the scoping review (Table 1). Of these articles, 13 were from Africa, making it the continent with the most contributions to the literature review. The most prominent country of publication was South Africa (8 articles), followed by China (2 articles) and Tanzania (2 articles). Other LMICs were also represented by one paper each. Seven of the studies are based on original research and the other 14 are analytical papers and essays or literature reviews. Six are book chapters, three are student research, and the remaining 12 are peer-reviewed journal articles. There was only one quantitative study in the literature reviewed.

Table 1: Articles selected for the literature review

Authors/Title*	Category	Purpose
Global		
Kennedy, et al. (2018) 'A scoping review to explore how universal design for learning is described and implemented by rehabilitation health professionals in school settings'	Scoping review Journal article	To examine literature on how occupational therapists, physiotherapists, and speech-language pathology therapists implement UDL within the school setting.
Botswana		
Trivedi and Mthombeni (2019) 'Incorporation of Universal Design for Learning in FCS Curriculum at Post-Secondary Institutions in Botswana'	Analytical essay Journal article	To explore factors that can positively influence the implementation of UDL in institutions of higher learning in Botswana, to impact on the teaching of family and consumer science subjects.
Brazil		
Costa-Renders (2019) 'Pedagogy of seasons and UDL: The multiple temporalities of learning involving the university as a whole'	Book chapter	To examine the interplay between UDL and notions of 'temporalities of learning' that encourage educationalists to foster the creative emergence of flexible times and spaces for jointly constructing knowledge with students in higher education institutions.

Authors/Title*	Category	Purpose
Cameroon		
Kamga (2013) 'Forgotten or Included? Disabled children's access to primary education in Cameroon'	Analytical essay Journal article	To analyse and discuss the inclusion of children with disabilities in primary education in Cameroon in relation to the different international and national human rights policies it subscribes to.
China		
Zhang and Zhao (2019) 'Universal Design for Learning in China'	Book chapter	To explore current developments in educational policy in China for students with special needs, the status of UDL and inclusive learning, and the challenges that implementing the UDL framework in China would encounter.
Arndt and Luo (2019) 'The Intersection of Chinese Philosophical Traditions and UDL: Exploring Current Practice in Chinese Early Childhood Classrooms'	Book chapter	To examine how practices in Chinese education are informed by the rich traditions from China, including how the philosophical influence of Confucianism set the stage for the principles of UDL in China.
Ghana		
Karr, et al. (2020) 'Inclusion of Children with Learning Difficulties in Literacy and Numeracy in Ghana: A Literature Review'	Literature review Journal article	To review literature on students with disabilities and inclusive education in relation to policy, contextual factors and practice in Ghana.
Iraq		
Al-Azawei, et al. (2017) 'The effect of universal design for learning (UDL) application on e-learning acceptance: A structural equation model'	Original research Journal article	To examine the effect of UDL principles on technology adoption perceptions of university students using the e-learning platform to which UDL principles are applied.

Authors/Title*	Category	Purpose
Jamaica		
Best (2016) 'Understanding the impact of a global universal design for learning (UDL) virtual classroom on Jamaican educators through the lens of how people learn (HPL)'	Original research PhD thesis	To assess the impact of a UDL virtual classroom project and how it achieved the 'how people learn' components (learner-centred, knowledge-centred, assessment-centred, and community-centred).
Kazakhstan		
Rakhimbekova (2019) 'Teachers' experiences and perceptions of Universal Design for Learning in one NIS school in Kazakhstan'	Original research Master's thesis	To investigate teachers' perceptions and understanding of UDL, how they employ its main principles, and the challenges they face while implementing UDL with learners with diverse needs.
Philippines		
Bandalaria (2019) 'Universal Access in Online Distance Education: A Case Study from the Philippines'	Book chapter	To present the development and implementation of the Universal Access to Learning for Development framework developed at the University of the Philippines Open University for open distance eLearning courses, grounded in UDL.
South Africa		
Chiwandire (2019) 'Universal Design for Learning and Disability Inclusion in South African Higher Education Curriculum'	Literature review Journal article	To explore the extent to which South African lecturers' curriculum practices are informed by UDL.
Dalton, et al. (2012) 'The implementation of inclusive education in South Africa: Reflections arising from a workshop for teachers and therapists to introduce Universal Design for Learning'	Report Journal article	To report on reflections from a workshop to introduce UDL to teachers and therapists.

Authors/Title*	Category	Purpose
Dalton, et al. (2019) 'Inclusion, universal design and universal design for learning in higher education: South Africa and the United States'	Analytical essay Journal article	To present concepts and examples of UD and UDL, and to discuss issues and potential solutions to help educators and others envision how they can take steps to reduce barriers to education in their own educational settings.
Lynner-Cleophas (2019) 'The Prospects of Universal Design for Learning in South Africa to Facilitate the Inclusion of All Learners'	Book chapter	To examine universal access as a way to foster inclusion and diversity in the South African education system using UD and UDL paradigms.
Mapepa and Magano (2018) 'Support to address barriers to learning for learners who are deaf'	Original research Journal article	To explore teachers' perspectives on support services needed to address barriers to learning of learners who are deaf.
McKenzie and Dalton (2020) 'Universal design for learning in inclusive education policy in South Africa'	Analytical essay Journal article	To locate UDL within inclusive-education policy framework in South Africa and discuss how UDL can support implementation.
Satar (2019) 'Promoting digital access and inclusivity in open and distance learning in South Africa: A UDL approach'	Book chapter	To explore the role of UDL in addressing the needs of disabled students (and staff), and to create avenues of digital access for students as a priority in enabling greater access into the future.
Song (2016) 'To what extent is Universal Design for Learning "universal"? A case study in township special needs schools in South Africa'	Original research Journal article	To examine challenges of implementing inclusive education and the applicability of UDL in two South African township schools from a teaching perspective.
Tanzania		
Braun and Okwako-Riekkola (2018) 'Ujamaa and Universal Design: Developing sustainable tactile curricular materials in rural Tanzania'	Original research Journal article	To present a case of collaborative efforts between US and Tanzanian partners to introduce UDL principles in a rural Tanzanian primary school.

Authors/Title*	Category	Purpose
Lyakurwa (2018) 'Universal design for learning towards achieving inclusive higher education in Tanzania'	Original research PhD thesis	To explore educators, Special Education Unit staff and students' perceptions of inclusive education at a university in Tanzania.

* The full citation for each title appears in the References.

Analysis of articles

A framework of themes for a deductive thematic analysis of the selected articles was drawn up with reference to the overall project objective to review current practices of UDL in LMIC settings with a view to forming recommendations for capacity-development resources and materials. The themes were:

1. Capacity building of teachers
2. Levels of technology
3. Diversity of target audience
4. Role of communities and families
5. Addressing systemic inequality
6. Policy supporting implementation.

Inductive analysis was used to consider areas that did not fit into these predetermined themes. Through this analysis, three additional themes were identified:

7. Disability and UDL
8. Challenges
9. Potential impact of UDL.

Each theme is discussed below.

1. Capacity building of teachers

Although teachers value the idea of UDL and believe its implementation would be beneficial, they often doubt the feasibility of doing so because they feel it is not relevant or adapted to their own contexts (Song, 2016; Braun and Okwako-Riekkola, 2018). Furthermore, UDL may contradict the current teaching philosophy in some LMICs, as in China where teachers typically design the curriculum around content instead of learners' abilities (Zhang and Zhao, 2019).

Despite this, when teachers in the South African context gained an understanding of the principles of UDL, they became aware that they already use similar practices when trying to cater for learners with diverse needs (Song, 2016). In Kazakhstan, Rakhimbekova (2019) also noted that, although teachers are generally not trained in and are unaware of UDL, they often use UDL principles in applying a differentiated approach, albeit to individuals rather than the whole class. Ghanaian teachers, however, are not trained in curriculum differentiation and questioned the need to differentiate for diverse learners as it may only benefit learners with disabilities rather than the whole group (Karr, et al., 2020).

Most teachers are not currently trained specifically in UDL implementation at school level (Song, 2016; Karr, et al., 2020; Dalton, et al., 2012; Al-Azwai, et al., 2017). One reason for this gap is that the instructors themselves are not trained in the use of UDL and accessible curricula in general (Al-Azwai, et al., 2017). Chiwandire (2019) reported a similar lack of lecturer training in South Africa. Although Chiwandire's study did not focus specifically on lecturers training teachers, the absence of UDL knowledge among lecturers in higher education institutions in South Africa indicates that they also lack UDL training. Faced with this reality, McKenzie and Dalton (2020) have advocated for teacher training on UDL in South Africa. In Cameroon, Kamga (2013) observed the need for teacher training, the provision of appropriate assistive technology, and a supportive policy framework.

Teacher training on UDL principles is happening on an informal level in some contexts, mostly with the support and influence of partners in high-income countries. In Tanzania, for example, Braun and Okwako-Riekkola (2018) described teachers who were not trained in UDL, but learnt through a collaborative process with partners from the USA. A study of UDL in Jamaica emphasised the importance of collaborative implementation of teacher-education programmes and the need for international resource sharing, as well as combined international and local leadership (Best, 2016). Local facilitators would be expected to be familiar with government policies and could alert programme designers to important contextual aspects, along with cultural norms and practices within schools and communities (Dalton, et al., 2012; Best, 2016). Best's study concluded that there are advantages to hybrid models of

professional development that offer outside expertise, resources and the flexibility of online platforms, but also incorporate peer learning and feedback. According to this study, once-off 'one-size-fits-all' professional development is insufficient and feedback is most effective when it is sustained over a period of. Teachers appreciated the flexibility and resources afforded by online learning, but also valued group meetings and face-to-face feedback and collaboration. In Botswana, professional development activities such as workshops, short-course trainings and seminars were recommended in the absence of formal training (Trivedi and Mthombeni, 2019). Zhang and Zhao (2019) suggest that, underlying these professional development activities, the UDL approach will likely need to change teachers' teaching philosophies in order to provide better development opportunities for students.

2. Levels of technology

Technology for UDL can be low-, medium- or high-tech depending on the level of support required by learners (McKenzie and Dalton, 2020). In this review there was some evidence of technology use. Rakhimbekova (2019) reported that PowerPoint, games, videos, audio-visual, various assistive technologies (mobile phones, tablets, laptops), reading text, electronic books and background music were available in the school where the study was conducted, and that learners also had an online site where they could work collaboratively. This study from Kazakhstan, and the experimental study by Al-Azawei, et al. (2017) in Iraq, indicated the availability of more advanced technologies in these contexts, with Internet access and the use of digital learning management systems. These two studies were the exception among the reviewed articles as many highlighted challenges around technology access and use (Song, 2016; Lyakurwa, 2018; Braun and Okwako-Riekkola, 2018).

A lack of resources is a major concern in rural communities and low-resourced schools in communities for poor populations (Braun and Okwako-Riekkola, 2018; Song, 2016). With the understanding that the implementation of the UDL framework in China is enhanced by educational technologies, there is a concern that socio-economic limitations pose challenges in some areas (Arndt and Luo, 2019). Even where high-technology devices are available, there remain challenges to their effective use in UDL. Lyakurwa (2018) noted that some tools

used in higher education in Tanzania are not universally designed and create barriers to students with visual impairment. These tools include assistive devices (Perkins Braille, typewriters, PAC Mates, and digital audio recorders), evaluation tools (tests and examinations with inaccessible formats or content), and teaching pedagogies such as learner-centred pedagogies. In China, schools and universities purchase life-long computer software licenses and typically only update their programs when needs force them to do so. Furthermore, YouTube is blocked by the Chinese government, which means educators cannot access some valuable resources available on this platform (Zhang and Zhao, 2019).

While there is an expectation that UDL requires resources and technology, teachers in some countries are making efforts to identify and adapt low-cost, locally available resources to use in their classrooms to engage learners with diverse needs. In South Africa, teachers identified low-technology resources that could be gathered and accessed through an education recycling centre which teachers use as a resource centre (Dalton, et al., 2012). One study with US and Tanzanian collaborators developed low-tech tactile materials from locally available recyclable matter (Braun and Okwako-Riekkola, 2018), and, in South Africa, Song (2016) found that teachers would bring items to use in class as concrete examples of concepts. While developing curricular materials using locally available recyclable materials seems worthwhile, in poor rural communities that lack resources, such as those in Tanzania described by Braun and Okwako-Riekkola (2018), this can be extremely challenging as many people do not have the financial means to purchase resources that end up as recyclable materials.

3. Diversity of target audience

The close association of UDL with inclusive or special needs education has led to the perception among some that UDL is only related to disability, rather than applying to all learners who learn in a diversity of ways. In Botswana, Trivedi and Mthombeni (2019) argue that the contextualisation of the curriculum for Family and Consumer Sciences should not only adapt for disability, but also be suitable for students from differing socio-economic backgrounds. They suggest that one way this could be done is by using multiple means of representation, for instance using examples understood by learners from various backgrounds.

Rakhimbekova (2019) notes a tendency for teachers to think about diversity in terms of cognitive activity at the expense of factors such as socio-economic status, ethnicity, nationality, religion, culture, language, gender, age, sexual orientation, special needs, and geographical or contextual factors, as well as their values and beliefs. In Rakhimbekova's study, the teachers' narrow understanding of diversity was indicated by their use of terms like 'strong' and 'weaker' to describe students. The study from Iraq by Al-Azawei, et al. (2016) considered other factors related to participant diversity, such as gender and age, by examining the impact of UDL on second-year computer science undergraduate male and female students between the ages of 18 and 22.

4. Role of communities and families

The role of communities and families is generally neglected in the literature. The few papers that referred to the role of families and communities cited negative attitudes towards persons with disabilities. In Ghana, for example, existing literature reveals a prevalence of negative and discriminatory views of persons with disabilities that impacts on their inclusion in education and society. Disability is often perceived as a punishment from God for past sins or as a curse on the family. The authors suggested that parents in this context may keep their children at home for fear of stigma if their intellectual disability becomes apparent at school, which may prevent identification and access to support (Karr, et al., 2020). Community issues related to poverty, mental health and drug abuse impact on school attendance, and some learners present with behaviour challenges. Such home and community circumstances make it difficult for parents to prioritise their children's schooling, leading teachers to take on a multi-faceted role in the hope of bringing a level of stability to their students' lives (Song, 2016). Karr, et al. (2020) also reported socio-economic challenges including poverty and malnutrition in Ghana. However, it is also the case that communities and families can be a resource and not just a problem. In South Africa, for example, McKenzie and Dalton (2020) have argued that the multi-disciplinary team needed to create a common understanding of instructional supports for learners should include learners' parents.

5. Addressing systemic inequality

Most of the papers in this review focused on disability or learning challenges without identifying the intersectionality of disability with other issues that might cause discrimination. However, among the challenges that were identified was socio-economic inequality. For example, it is noted in South Africa that inequity challenges would need to be addressed for the success of disability inclusive education systems (McKenzie and Dalton, 2020; Lyner-Cleophas, 2019).

The potential of UDL to address systemic inequality is noted in several papers, but as an aside rather than a main feature. Reference is made to different socio-economic backgrounds (Trivedi and Mthombeni, 2019) to ensure examples are contextualised for students from different backgrounds. UDL has both the potential to support systemic change as well as requiring systemic change in order to be implemented. For example, Chiwandire (2019) highlighted the need for university management to participate in research and efforts to promote UDL if change is to occur. The adoption of a UDL approach also opens the way for considering change at a deep and broader level (McKenzie and Dalton, 2020). Song (2016) notes that teachers used strategies like code-switching to accommodate learners with different home languages and used tangible examples to explain concepts to include learners who were not proficient in the language of instruction. Chiwandire (2019) reported negative attitudes from lecturers, such as perceiving students with disabilities as incapable, impacting on the inclusion of students at South African higher education institutions.

The use of UDL is particularly invoked to address the systemic inequality faced by students with disabilities. Chiwandire (2019) notes that university students with disabilities in South Africa have faced multiple forms of exclusion that could be reduced through UDL training in universities. This is supported as a way to address not only the inequalities resulting from apartheid, but also diversity related to disability (Dalton, et al., 2019). Deaf learners find themselves excluded where adaptations are not implemented and the UDL framework is recommended as a way for South African teachers to address this (Mapepa and Magano, 2018).

A further element of systemic inequity operates at a global level. Song (2016) questions the extent to which a concept created in Western contexts, such as

UDL, can be imported into the global South where poverty is a driving force. This impacts the level at which students enter the classroom as well as the ongoing gap between their home contexts and the context in which this framework was devised. Song (2016) therefore advocates for a critical and contextualised approach to UDL in the global South. This decolonial perspective is echoed by Costa-Renders (2019), who identifies what she terms 'monocultures' as sites where the approach of 'one-size-fits all' is adopted in a historically legitimised fashion. UDL is then seen as a mechanism to confront monocultures as it presents multiple ways of interacting that can challenge the hegemony of Western pedagogy in universities. On a practical level, using local resources can minimise the Western and high-tech well-resourced focus of UDL, such that children may enjoy greater access to the curriculum (Braun and Okwako-Riekkola, 2018).

6. Policy supporting implementation

The literature mostly refers to countries' inclusive education policies, their poor implementation, and the potential role of UDL to inform policy and improve implementation (McKenzie and Dalton, 2020; Kamga, 2013). Karr, et al. (2020) report the existence of a policy that supports UDL in Ghana, suggesting that pre-service teacher trainees could be receiving better training in UDL. However, this is not currently apparent as most teachers in Ghana lack training in differentiating instruction and adapting the curriculum or materials (Karr, et al., 2020). Another limitation of this policy is that it excludes so-called 'severe disability' which would be at odds with the UDL framework (Karr, et al., 2020).

UDL is seen as an instrument for policy implementation and operationalisation, most notably that of inclusive education. McKenzie and Dalton (2020) argue for UDL as a strategy that could link policy to classroom practice. They use the example of the Screening, Identification, Assessment and Support strategy in South Africa to illustrate how UDL can help teachers to understand support as it is presented in the policy. Costa-Renders (2019) posited that UDL is an effective tool for challenging rigid policies that do not take into account the individual experiences of university students in Brazil. In the absence of flexible approaches such as UDL, teachers may revert to exclusionary positions. For example, Song (2016) found that some teachers in special schools in South

Africa were opposed to inclusive education on the grounds that children with disabilities would not be accepted into or catered for in mainstream schools.

Given that UDL is often linked to inclusive education, the place of UDL in policy depends on the status of inclusive education in that particular context. Where inclusive education is not implemented, neither is UDL (Dalton, et al., 2019; Kamga, 2013). However, disability in policy and practice can, in some instances, be a catalyst for exploring new ways of learning and teaching that challenge educators to think differently and consider UDL in their own contexts (Costa-Renders, 2019).

7. Disability and UDL

According to Trivedi and Mthombeni (2019), 'UDL' and 'inclusive education' have been erroneously used interchangeably, with the effect that UDL is often seen as only effective for children with disabilities. In Brazil, Costa-Renders (2019) offers an intriguing perspective in which disability inclusion is seen as a catalyst for the application of UDL principles in a university setting. When students with disabilities are present and recognised within educational programmes, the inadequacy of a one-size-fits-all approach becomes glaringly obvious, leading to recognition of the need for increased flexibility for all students. In this process the homogeneity of learners within disability categories is also challenged. For example, the experience of visual impairment is not the same for different individuals. Similarly, the distinction between 'disabled' and 'non-disabled' learners is eroded in curriculum design based on UDL principles.

The pressing material needs of children in LMICs affect the way in which diversity, disability and difference is understood, and teacher resistance may be the result of overwhelming daily challenges (Karr, et al., 2020; Braun and Okwako-Riekkola, 2018). In these contexts inclusive education may be seen as a low priority, affecting only children with disabilities, and UDL and inclusive education are poorly understood as interchangeable concepts (Trivedi and Mthombeni, 2019).

8. Challenges

There are numerous challenges to the implementation of UDL in LMICs. Some of these are rooted in the education system as a whole, such as large class sizes,

extremely difficult working conditions, lack of resources, and low pay. Teachers also need to consider students' personalities affecting their learning, student behaviour, and classroom space (Song, 2016; Braun and Okwako-Riekkola, 2018; Rakhimbekova, 2019). In South Africa, teachers may agree that the UDL philosophy is highly beneficial for students, but they do not feel they can implement it because of insufficient resources (Song, 2016). Rakhimbekova (2019) also cites a lack of options for executive functions such as goal setting, strategy development, and support planning. Another reason for teachers resisting UDL is the focus on summative standardised assessments (Braun and Okwako-Riekkola, 2018).

Other challenges are more closely related to dealing with diversity in the classroom. In Ghana, for example, differentiation is absent and the curriculum does not support it as it is inflexible. There is a lack of support professionals to guide teachers in adapting their teaching, inaccessible environments, and an absence of effective screening and identification services (Karr, et al., 2020).

Zhang and Zhao (2019) note language and cultural challenges in disseminating knowledge about UDL. There is no Chinese website on inclusive learning or UDL, and these are not popular topics in Chinese educational research. The development of UDL in China is in its infancy and very few researchers and practitioners are paying attention to it, let alone adopting it. In Cameroon, Kamga (2013) cited legal and cultural challenges that impact on the inclusion of children with disabilities in schools and the implementation of UDL.

Song (2016) additionally highlights the need for physical space and assistive devices in the existing educational structure. Rakhimbekova (2019), in Kazakhstan, also reports the challenge of learner diversity in comprehension, knowledge, and behaviour or personality, which requires a diversity of teaching approaches. Chiwandire (2019) cites a similar challenge of absence of coordinated efforts between relevant higher education stakeholders in a South African university, such as lecturers and university management personnel. Song (2016) also identifies the challenges of implementing UDL where there is a lack of human resources and professional development opportunities, such as in-service teacher-training programmes. Few teachers have a special education background and teaching credentials. In addition, some teachers have low

expectations of their students' learning capabilities and thus question the applicability of some inclusive teaching strategies (Song, 2016).

In Ghana, socio-economic issues (for example, poverty and malnutrition) and culture have been noted to affect the education of children with disabilities. Some traditional practices may lead to negative attitudes towards disability, making some parents reluctant to have their children with disabilities identified because of the resulting stigma (Karr, et al., 2020). Kamga (2013) also mentions legal and cultural challenges in Cameroon that impact on the inclusion of children with disabilities in schools and the implementation of UDL. However, Costa-Renders (2019) observes that some policies in higher education disregard students' variability, emphasise homogenising people, and stipulate delimiting delivery of services. To address diversity, Costa-Renders (2019: 172) notes the necessity of breaking 'the monoculture of linear time in higher education'. There is also the acknowledgment that teachers and lecturers' attitudes and resistance might stand in the way of the use of UDL, especially where disability is associated with inability and low expectations (Chiwandire, 2019).

9. Potential impact of UDL

While there are many challenges and sparse application of UDL in LMICs, there is quite strong recognition that the approach has a lot of potential. In Ghana, Karr, et al. (2020) contend that, when teachers are trained on how to implement UDL strategies in the classroom, it will ensure higher achievement outcomes and thus reduce the risk of stigma for children with disabilities. In Brazil, Costa-Renders (2019) sees UDL as a vehicle to disrupt homogenisation of learners and the development of monocultures creating more collaborative approaches. In higher education, there can be increased digital inclusion if, based on the principles of UDL, support structures are implemented that support equity and accessibility (Satar, 2019).

Zhang and Zhao (2019) note that UDL's features of openness, flexibility and foresight have the potential to enlighten teaching and learning practice in China, moving the focus of current teaching methods from the curriculum and texts to the learners. Arndt and Luo (2019) also draw on traditional philosophy in this regard, in that the UDL framework blends well with Confucian ideals of personal responsibility, interactive learning, and meeting students' needs. Despite a move

away from these values in the past, Confucius' teachings can help Chinese teachers meet the needs of diverse learners and embrace strategies that seek to give all students access to the curriculum in contemporary China. This is a first step and, with more professional development in UDL, teachers will become more adept in how to differentiate for inclusive teaching.

Key points

- Capacity building for teachers in UDL should include in-service and pre-service teachers.
- The needs of teachers are diverse and not 'one-size-fits-all'.
- Pressing material needs in LMICs affect the way diversity, disability and difference are understood.
- Teacher resistance may arise due to overwhelming daily challenges.
- Inclusive education may be seen as low priority and affecting only children with disabilities.
- UDL and inclusive education are poorly understood as interchangeable concepts.
- Localised understanding of UDL based upon local teaching practice are necessary.
- Collaboration with educators and researchers from high-income countries with more experience in UDL is a useful strategy, but needs to be seen as an equal partnership rather than a one-way transferral of expertise.
- There is a debate about the use of technology and low tech, and locally available resources are suggested for use in LMIC contexts.
- Teachers should have the opportunity to develop digital literacy and online skills in order to support the development of digital literacy in their learners.
- The role of families and communities needs attention, and teachers should understand how they can draw on families and communities for support, and engage them in the best interests of the learners.
- UDL can operationalise inclusive education policies, is a tool to equalise opportunity, and has the potential to address systemic inequality.

Insights from the literature review informed the questions asked in the interviews with key informants on UDL in LMICs, the findings of which are presented in the following section.

3. Analysis of interviews

Interviews were conducted to gain a deeper understanding of current UDL initiatives in LMICs that may not yet be reported in the literature. Key informants in education development work and UDL were asked about the critical issues and recommendations they might have for the implementation of UDL in LMICs, with a particular focus on capacity building.

Methods

Seven individual or group interviews were conducted with a total of 11 key informants from the Bethany Society (four participants), CAST (two participants), the United Nations Children's Fund (two participants), the World Bank (one participant) and the University of Zimbabwe (one participant). An independent UDL researcher was also interviewed. These participants were selected purposively based on their job portfolios and publications in relation to education as well as practical field experience, technical knowledge and expertise in UDL. An interview schedule was developed based on the findings of the literature review (Appendix 3). The study was approved by the Human Research Ethics Committee of the Faculty of Health Sciences at the University of Cape Town, South Africa. All interviewees were given information about the project and had the opportunity to have any questions answered before signing a letter of informed consent. The interviews were conducted virtually via Zoom and recorded with permission of the participants. After the interview sessions, the recordings were either transcribed manually by the researchers or the transcripts were obtained from Zoom. These were checked for completeness and corrected as necessary by comparing them with the audio recordings.

The data were analysed deductively based on the eight questions asked during the interviews. These specific questions informed the themes. Data analysis entailed reading the answers to the questions and coding these manually using Microsoft Word's 'Comment' function. The researchers undertook the coding independent of one another to enhance the confirmability of the findings. The codes from the different transcripts were then compared and grouped according to similarities and differences. The findings are presented below in a narrative form, with some direct quotations extracted from the transcripts to illustrate the

themes. For confidentiality purposes, the names of the participants and the organisations to which they belong are not given in this analysis.

The themes were:

1. Experience and understanding of UDL
2. UDL supporting inclusive education
3. UDL in teacher-training initiatives and capacity building
4. Technology and digital literacy in UDL
5. UDL and addressing equity issues and discrimination
6. Challenges and potential of UDL.

Each theme is discussed below.

1. Experience and understanding of UDL

In the interviews, participants commented on the significance of UDL as a philosophy that underpins inclusive teaching approaches. It is seen as a tool to support the achievement of the SDGs in its response to diversity, and answers the call to 'leave no-one behind'. As attempts are made by way of inclusive education to get children with disabilities back into the mainstream, there is recognition that much broader issues than disability are at stake. UDL is a way of thinking, a philosophy of teaching and learning, that aims not only to give all learners access, but also enable their participation and success. Thus, the implementation of UDL was seen as a priority for participants:

Education is the key that unlocks all doors, it is the pivotal right, and all other rights become possible if this right is granted. For me to know there is access to health, I should be educated enough to know that.

UDL also offers concrete guidelines: 'to take evidence and make it actionable for practitioners'. In this sense, it was described as 'really powerful'. The shift that takes place in implementation is that 'the problem is never with the children; the problem is with the system'. Thus, a feature of UDL that was noted is how it enables thinking at a systemic rather than an individual level, 'putting the child at the centre rather than putting the curriculum at the centre' and working on 'integrating UDL principles in the programming to ensure inclusion'. This systemic approach means that UDL is 'now at a point where it has influenced the

ministries of education of the involved countries to take ownership and incorporate UDL in their practice’.

Several respondents were trained as special education teachers and had found the ‘traditional marginalisation of, especially, disabled students’ to be unacceptable. They then looked for ways to address this exclusion. As they sought greater equity and access to education they began to use various differentiation strategies, which they only realised afterwards were similar to UDL principles. As one person expressed: ‘Having been a teacher who has taught in the classroom for a very long time, we never articulated these as UDL principles.’ Although these practices were used, they were not identified as UDL at the time, with one participant saying that: ‘UDL practice has been there for some years, but to call them as UDL is something I have heard over the past two years.’ The recognition was so strong for one participant who said: ‘I thought this [UDL principles] could have been written by me!’

Participants noted that, given that the concept and practice is not unfamiliar, care needs to be taken that UDL does not become a meaningless buzzword where there is ‘a whole lot of confusion about this new terminology’. They likened this to the introduction several years ago of the term ‘reasonable accommodation’, and argued that the introduction of new concepts should be linked and grounded in what educators already know and then expanded from there. In India, there was a concerted effort to relate UDL to existing practices as ‘a kind of a crosswalk between UDL, backward design and responsive teaching ... to look at ... these three (principles) and we use this then to design lesson plans’. Not only did UDL help them to describe their own differentiation practices, but it also gave them a ‘framework or a solid evidence base that we could really point to’. This contributed to a holistic framework to plan, implement, monitor and understand teaching practices that they had already found worked well for diverse learners.

When individuals came across materials and guidance from CAST, they highlighted the capacity of a UDL approach to excite and inspire as ‘this just felt like such a useful framework. It was just filling me with ... inspiration to take it into my new work as a teacher’. The power of the approach also became apparent through carefully looking at students’ work when it was designed using

UDL, and being able to see the 'kinds of thinking that were possible among students when we were designing through a UDL lens'.

2. UDL supporting inclusive education

The general sentiment of the participants was that inclusive education and UDL cannot exist independent of each other. They saw UDL as a facilitator for inclusive education and all agreed that inclusive education cannot be complete without UDL. Using phrases like 'it is a question of chicken and egg, to me it is an issue of an egg and chicken, you cannot talk about inclusive education without UDL' and 'UDL is like the other side of the coin', UDL was seen as a means to ensure education for all. Another view was that inclusive education is a broader umbrella concept and UDL is an instructional approach that provides an operational framework to implement flexible teaching in inclusive education. UDL was not only identified as a framework, but also as a theory or philosophy to inform inclusive education: 'The other big powerful thing about UDL is it is a framework that we can follow as well as the theoretical idea.'

UDL was described as a means or strategy that enables the shifting of teacher mind-sets from learner deficits to environmental barriers and to enhance teacher capacity to deliver inclusive education. It was likened to the social model of disability as it shifts the focus from learner deficits to problems with the curriculum: 'The problem is never with the child, but it is with the system.' The potential of UDL to address stigma and low expectations of learners with disabilities was also highlighted. UDL enables teachers to start with the learning goals, without focusing on the perceived limitations of the learners, 'making sure that all students are feeling welcomed'. This was related to 'the core value proposition of UDL, which is to flip that and say no, it's the curriculum that is broken, that is inflexible, and just that inherent kind of belief system of valuing everyone's unique genius...'

Using UDL, inclusion goes beyond access to full participation of all learners. It impacts the curriculum and learning materials by targeting the three principles, and it is seen as a 'potentially powerful lever in designing inclusive learning environments'. At a broader level, inclusive education was equated to 'inclusion to life; preparation for inclusion to all areas of life'. Through the holistic

instructional approach, all learners can feel included and enjoy learning, and the teachers can 'make learning not like a prison, but like a holiday resort'.

Some participants shared that it is the practice and not the terminology of UDL that matters:

For me, whether you call it UDL or not, it doesn't matter. It's about unpacking some of those concepts: How do you engage? How do you facilitate action? How do you present your material in a wide variety of ways? ... that you really respond to the diversity of the classroom.

Consequently, UDL was viewed not as an entirely new concept, but one that provides a more comprehensive framework to inclusive education. The need to embrace other ways of doing inclusive education and to use UDL as a leading idea that can influence policy was highlighted:

UDL has important relationships to things that we already have studied about, but it provides a vehicle for bringing many of those things in so that they can impact policy. So I don't like to see UDL as like the only thing that's talked about. I think that we should be talking about inclusive instructional design and UDL can be a leading idea.

Some participants shared models of good practice in their work contexts. For example, in India, the government is aligning education policies with the UNCRPD and the SDGs. This creates an opportune time for UDL in India as a lot of transformation is happening in the education system at government level and UDL can be promoted through small NGOs. However, participants cautioned that, although the policy framework is improving and funding is being made available, an understanding of UDL is largely lacking. Notably, limited capacity to understand UDL both at country level and by educators was a common concern among participants. They saw this limitation as impacting on the training of educators: 'From the point of even at the government level I don't think the concept of inclusion is understood, so training is suffering.' Hence, capacity building was advocated for at the policy level for UDL to be cost effective. 'Everyone is talking about it but unaware of what is needed to support it. The heaviness of what is needed is not understood yet.' Participants advocated

for inclusive education policies that enforce UDL as a strategy for providing education to all learners.

3. UDL in teacher-training initiatives and capacity building

UDL has the potential to transform inclusive-education training initiatives in LMICs because of the current shift in mind-set (from a medical model mind-set to an inclusive way of thinking), which the participants are observing in many countries. Understanding UDL as a concept and why it is important for learners was emphasised. There is a need to move from the common 'theoretical' training happening in LMICs to more practical, hands-on approaches:

We have thousands of experts on education who speak on UDL, but always on a very theoretical note, and it's very difficult for trainees afterwards to apply.

The practical training has to be bolstered by evidence of 'true stories' of successful implementation of UDL:

I think for a lot of teachers who might be feeling like 'Oh, UDL, is it for me?', I really strongly believe that seeing that evidence, showing what works for students, showing examples of work and also video footage of classrooms, to really be sharing what's possible, I think that can be a really powerful hook for teachers.

Despite the observed shift in mind-set, challenges still exist when it comes to teachers practising inclusion. A common concern was that teachers can be rigid, preferring their old ways of doing things. An example was the persistent idea of separating special education from mainstream education: 'At this stage in LMICs we should not be talking about special education. What is special about a basic human right?' At a practical level, it was felt that teachers need to be trained to aim to teach learners 'to problem solve and to apply their knowledge, rather than just recall'. Also, by using UDL, teachers can move away from 'writing lesson plans to designing lesson plans'. UDL needs to be included in policy for designing pre-service teacher training and not be added as an afterthought that requires costly adaptations to the system: 'The push for design in the early stages within the education system is what seems to be desirable.'

It was pointed out that the levels of and requirements for teacher training are very diverse in different contexts. Frequently in LMICs, training aims to impart

basic knowledge and most teachers have no understanding of diversity. Using UDL in teacher training would be one way to capacitate teachers and 'it also has an impact with regards to curriculum and learning materials, as well as with assessment, sort of understanding how UDL influences and shapes all three of those strands'. One challenge of lack of teacher capacity was that some countries were only trying to implement UDL in certain aspects of their pedagogy, for example in curriculum design as well as in developing learning materials and/or assessments, which is not enough for the full inclusion of learners.

What we've seen so far is that there are several countries that are maybe trying to adopt one of the three, which is a great starting point but it's not going to get us to inclusive education just on its own.

To address the diverse needs of teachers from different backgrounds, emphasis was placed on context-relevant and context-specific teacher training, starting from where teachers are, as 'not everybody comes in at the same level and not everybody has the same needs as to what they get out of the course'.

More focus on UDL in teacher training in LMICs was raised as a pertinent need. For example, there was a need to include a full module on UDL in pre-service training and to ensure ongoing support for in-service teachers. The biggest challenge is to move away from the teachers' traditional ways of doing things and 'the shift needs to happen inside first'.

Additionally, a systemic approach to teacher training in LMICs is lacking. Systemic change needs to be effected by engaging stakeholders from different sectors as well as law makers in order to address gaps in the system that need to be addressed for effective teacher training. Training needs to be approached from a 'multi-sectoral interdisciplinary way ... because it is not only about providing screening, but providing contextual information to teachers about what are the resources and support within the system which is available to them'.

Examples were shared of progress in a few LMICs that have started adopting UDL in their inclusive education practices. One participant recognised the critical contribution of UDL and has started implementing it in teacher education.

She motivated for the inclusion of UDL as a core component of teacher-training courses:

It will be difficult to graduate a teacher who does not understand UDL. So we need to repackage teacher training so that it brings out a teacher who is orientated to diversity, a teacher who knows there are different ways of killing a cat, who knows that the child should be given this right. Not that there should be someone else special to come along and give them that right.

Participants also noted that training needs to be a process that is accompanied by a plan and ongoing support:

I think that any time you do a training it's important for the individuals who are bringing you in to think about, okay, what are we going to do next? After this training, how are we going to continue to support those ideas so that they will grow and so that people have an opportunity to, you know, ask questions when things come up?

Given the scarcity of UDL adopters and a lack of understanding of the concept, capacity building for teachers was expressed as a real need in LMICs. It was suggested that capacity building has to start at ministry level for it to have an impact on the countries' inclusive-education policies. The buy-in of policymakers was also emphasised as necessary for schools and teachers to get guidance and support, and for clearance to spend resources on capacity building without fear of 'getting in trouble for spending their public dollars in this way'. Hence, involvement of government authorities and policymakers is also crucial for financing and sustaining UDL training programmes.

Capacity building of teachers needs to start with ensuring their understanding of UDL by, for example, training them to focus on 'SMART goals and valuing formative assessments'. Capacity building is needed in setting goals that include different inclusive ways of measuring learning and moving away from the commonly used standardised assessments that '99% of the time ... aren't inclusive'. Another critical element of teacher training is equipping them with skills to screen and identify learners' specific learning needs:

How do you support the teachers to get the basics around screening and assessing and placing children at the right level,

and making sure that they're able to support them in that particular regard?

Training manuals or 'toolkits' that are 'simple and straight to the point' were identified as an effective approach that would provide teachers with materials to work with at pre-service and in-service levels. As part of capacity building, teachers need to be aided to understand that UDL is not all about technology, although technology might ease implementation in some instances. 'Decoupling it [UDL] from technology is so important.' Teacher training can be enhanced through blended learning, which follows some models that have worked in high-income countries, such as the CAST programmes which use 'online modules that allow for self-paced learning ... various kinds of coaching structures and hands-on learning opportunities – it's a good mixture of elements'.

In some instances in the USA, UDL was reported to form part of the pre-service curriculum. However, there was no formal training for participants outside of the USA. As one participant expressed: 'I have just used the internet. I have self-taught myself and read a lot about UDL. I have just learned UDL, but I do not have a qualification in that.' This is where online materials have been very useful and have clearly had a huge impact. In India, NGOs have accessed and used CAST resources and, although they have never received formal UDL training, they have continued to educate themselves and other teachers through experience and self-teaching. Based on this experience, teacher educators have begun to include UDL in their formal curriculum. As one participant stated: 'What I have done personally, because I have seen the importance of UDL in one of my programmes, we now have a topic on UDL that I teach my students, because I have seen the importance.' However, this is seen as a stopgap measure and student teachers need to 'make sure that whatever you learn here, you take it further and into other areas'.

The introduction of UDL in LMICs is frequently initiated through international collaboration. One participant learned about the approach on an exchange visit to Canada and then implemented it in LMIC contexts. There was general recognition that such collaboration needs to be carefully managed so that 'on-the-ground organisations do the actual UDL training and carrying the work forward'. There is a need to build 'capacity so that trainers who live in these

lower- and middle-income countries are themselves equipped to be their local UDL experts, and be able to really support UDL practice in their own authentic context'. The importance of different contexts was expressed by one participant referring to the myth of the average learner, saying:

As there is no average learner, there is no average learning setting. As we carry our work forward globally, we want to make sure that we're really empowering the local experts.

What was also clear was the enormous influence of CAST and their online materials in spreading the philosophy and practical implementation of UDL. Most participants read CAST material, not only for themselves, but also to include in the training programmes they offered. They 'were able to look at CAST, website, etc. and use that extensively'. For practitioners in the USA, there were close links to the founders of the UDL approach, with one participant stating: 'David Rose, who is the co-founder of CAST, taught a course on UDL in the Spring, right before I was about to graduate, and I was totally hooked on the idea of UDL.' CAST has offered keynotes, rather than direct training on a global scale, but they are considering how to extend training by taking into account multiple contexts and situations.

Another strategy suggested for capacity building was approaching it incrementally, starting with small 'UDL teams' of five to ten educators and an administrator. These teams would receive training and then become the influencers in their schools. Collaboration among the adopters of UDL in LMICs through ongoing mentoring and peer support was emphasised, with suggestions for building 'professional learning networks' using means that are viable in each specific context, such as WhatsApp groups. Peer learning and the sharing of information and UDL practices can also be encouraged through 'instructional rounds', where teachers observe each other's lessons while implementing UDL.

When they hear it from their own colleagues, and hear that this is working in my particular context, in my particular school, that's oftentimes what gets teachers to think like, okay, maybe I want to do it.

To further enhance UDL practice, it is important to 'try and motivate teachers to get into the whole concept of designing a learning environment'. Collecting evidence with teachers on the practicality of UDL also helps to motivate them.

Seeing student work that really exceeded teachers' initial expectations was a huge motivator for them in terms of learning more about UDL and wanting to continue to experiment with UDL in their classroom.

Some of the participants shared information about some 'promising' training courses on inclusive education that are incorporating UDL in their content. However, teacher training needs to move away from a 'project-based approach' where teachers receive short workshops or seminars that are quite 'theoretical ... or may not be tied closely to the local context' and are not followed up with ongoing support. A more systematised way that ensures that teachers are supported to use and 'fortify' what they learn from UDL training is needed.

You know, you can take teachers out of the classroom, give them a lot of really great information, and send them back in. But if they don't have anywhere to go for further follow-up or further support ... it's going to make it very difficult for them to have a positive experience with that.

A major concern was around the best way to initiate capacity building for teachers. For example, 'What is the basic minimum requirement to get it going?'. The systemic change needed at policy, infrastructure and teacher-support levels raised such concerns. Participants suggested a potential way to overcome this challenge was involving teachers in developing the UDL training material to meet their context-specific needs by asking questions like 'Where can you start?' and 'How do you think UDL will make a difference?'. Participants involved in teacher training emphasised:

... learning from local contacts about what training methodologies are going to be most helpful, and if there are pieces in our training ... that ... will need to adjust to make it more culturally competent for a particular setting and for a particular country's concerns.

The bottom-up approach of starting with smaller teams (early adopters) was also suggested as crucial to capacity building. Additionally, awareness-raising about UDL among teacher-training institutions in LMICs was highlighted as important and an approach that has been effective in the USA.

Capacity building of teachers needs to be approached through a social model lens because 'teachers are part of the society, and we know attitudes, cultures

and beliefs have an impact on how teachers respond to diversity in the classroom'. Using this approach, the social determinants influencing inclusive education and the participation of children with disabilities in schools can be addressed. A shift needs to happen in the minds of teachers from 'thinking of training for inclusion of children with disabilities, but training for inclusion for teachers to deliver good education'. Teachers also need to be trained to distinguish between access to the classroom and inclusion in learning, and to understand that UDL aims for the latter.

Capacity building of teachers also needs to be supported by families and communities 'in terms of drawing the support and really making parents as partners in the educational planning of children in the classroom'. Community-based programmes that use a human rights approach, such as community-based rehabilitation, may be used as a support structure for teachers. The fact that there is a community they can draw upon 'is something that needs to be well understood and then proposed as part of the training ... delivered to teachers'. That way an ecosystem, which will take different forms depending on the context, can be leveraged. 'In every culture and context, the situation will be different and we need to take note of that.' Through the ecosystem, there are 'some tangible things the teachers can use in the classroom that are very contextual'.

Capacity building also needs to address digital literacy. There was a sentiment among participants that many teachers working in LMIC contexts 'don't necessarily know what's available and how to use it'. At the same time, teachers need to be trained to acknowledge that UDL can be used in contexts with varying technology levels. This observation is expanded on in the next theme.

4. Technology and digital literacy in UDL

'Many, probably 70 to 80% of the teachers in low- and middle-income countries may not necessarily have the skills with digital and online learning.'

Consequently, teacher capacity-building in digital literacy is indispensable if online instruction is to be used as a tool for teacher education. However, such capacity building should begin with a needs assessment and an understanding of the context because 'it's not about whether online education will be successful or not, but it's really about where will it be successful?'. Important considerations

are the contextual needs of teacher trainees, such as the availability of and access to resources and technologies in LMICs, and whether teachers with disabilities are accommodated in the technologies available. It was also felt that training in digital literacy should start at the pre-service stage, in order for teachers to better appreciate inclusive practices.

Training in UDL should be a bridge between online learning and home learning, where trainees are 'involved in practicalities in the home and they bring it back online'. It is also important for online learning to 'walk the talk' of UDL, with accessibility to online material aligned with UDL principles. The goal is to 'provide the same sorts of flexibility and affordances that we would want offered to students in classrooms'.

Discussions and collaborations during training should be encouraged, thereby enabling teacher trainees to learn from each other. Communities of practice should also be encouraged. Trainees should 'have an opportunity to interact and share their ideas, and to discuss afterwards'. Ample time should be provided during training for real-time interactions and feedback, such as using free-to-access online resources such as Google Drive, Google Docs or Zoom breakout rooms. Using the example of lesson plans:

If we're moving forward with online learning [there is a need to] have discussion boards, that we have the kind of resource-sharing capacities within an online environment where we can share each other's lesson plans, and ... kind of comment on, for instance, 'I'm not sure how to address this in this lesson plan' – What are your thoughts? What do you think about that? What ideas do you have?

Given that 'the future is blended learning', there is a need to consider the best way to include teachers in online learning. While capacity-building training using online models is important, equally significant is recognising the gaps and making the intervention incremental. Many free resources are available online and those from CAST have been found particularly useful. However, teachers might need to be motivated to use technology if they lack confidence in the approach.

Some of the teachers shared with me that they were really hesitant, and they weren't sure if all learners would be able to engage in those really sophisticated practices.

Moreover, the materials presented during training might need to be adapted for computer and mobile-device users, depending on the technology trainees have access to. Importantly, Internet connectivity needs to be considered during training as some teachers might be left behind while others benefit.

[What] I did find out in my work around the world is that not everybody has good access to online instruction, so sometimes we need an in-hand on paper tool. Yeah, always keep that in mind.

Funding for online learning would be more easily accessible if UDL was integrated into teacher education as part of the curriculum. While this is not currently the case, 'there needs to be funding – a university, a department of education, or the school department, or a non-profit'. Innovative resource mobilisation is required to support online training, particularly where trainees might be unable to afford specific resources such as training books. Plans also need to be made to remunerate external trainers.

Participants cited mobile phones, WhatsApp, Google Apps, Microsoft Teams, videos, laptops and local materials as some of the most viable technologies that could be used in LMICs. Additional useful materials can be recycled from warehouses, businesses and other organisations, which underlines the central role of the community in sourcing materials.

You could use community rehabilitation workers and connect them to businesses to get materials, and perhaps this could be done through a non-profit. And then think how to get the materials out there [to schools].

The need for technology to address the needs of all learners, including those with disabilities, was emphasised. On this front, progress has been made in developing new technologies, including eKitabu's work (n.d.), which refers to adaptable learning materials for learners with disabilities. Disability-specific technology has also developed. For instance, 'there are excellent apps that have been developed in India to help children who are non-verbal'. The need to contextualise the use of technology is highlighted, as well as the view that no

one technology fits all contexts. The example given is that 'we've seen many, many situations where tablets are introduced into classrooms, but the children don't have electricity at home, so that tablet stays in the classroom behind lock'. Improving access to technology needs to be matched with the empowerment of people and communities in digital literacies and the upskilling teachers, 'otherwise you're just ensuring better access to Netflix!'. If technological growth is considered by policymakers at a global scale, as are economic competitiveness and growth, it would be possible to leverage that commitment and pair it with the provision of technology for UDL.

Participants felt that associating UDL so closely with technology could make the framework backfire:

I do believe that the association between UDL and technology has made the idea of UDL implementation feel more intimidating or more out of reach for some countries than it needs to.

It is noted that, although technology is important, UDL does not necessarily depend on it. UDL could be used to introduce technology instead of only using it to introduce UDL. Given that over-technologising UDL is unrealistic in low-resource settings, the recommendation is to focus on low-tech and no-tech approaches. Participants pointed out that many low-tech resources for remote areas already exist, and that ways to integrate these technologies with information and communication technology are needed.

Training materials need to be repackaged for online delivery that will suit a diversity of audience as well as to download for use offline. Mobile technology could be exploited for this purpose given its prevalence in LMICs.

How can I frame the materials, the opportunities and things like that, so that they get delivered through these mobile technologies, so that people who may not have computers but they have a phone can participate?

The impact of gender also requires attention:

There is a gendered lens to access to technology for learning for girls with disabilities, where that is again a huge challenge in countries where there is sharing of devices happening all the time.

When it comes to technology that can be used in UDL in LMICs:

... there is a huge potential, but we need to skill-up, we need tech innovations, asynchronous or synchronous, which work for all children in presenting learning materials which are aligned with the principles of UDL.

5. UDL and addressing equity issues and discrimination

Participants felt that UDL promotes participation for all learners in the classroom:

[It's] not just tokenistic, that these learners are in school and it's just about statistics, but actually they meaningfully participate in the education system because it's designed in such a way that is responsive to their specific needs.

This indicates that UDL shifts focus from the number of children enrolled to their meaningful participation. It also moves beyond tokenism to address:

... all levels of policy, implementation financing and, of course, effectiveness in terms of the monitoring of the actual outcomes and how it's actually working in addressing those inequalities.

Importantly, the idea that UDL is only for children with disabilities is dispelled, with emphasis rather on its benefit for all learners. Participants brought to light other intersections that require attention when talking about inclusion and UDL, such as the need to develop 'culturally sustaining pedagogy or anti-racist teaching or restorative justice'. UDL can also empower and emancipate previously disadvantaged groups. For instance, one participant noted that 'in Canada, UDL is used to support inclusion of indigenous populations and working on the reservations that they used to have'. LMICs could also use such a strategy to include those left out of mainstream education. This focus on learner variability is seen to address equity issues because teachers appreciate the individualised scaffolds needed by learners.

In addition, UDL helps educators to move from a medical model of disability to a human rights, diversity and inclusion perspective. Teachers are supported 'to break away from some of the ways that they've been socialised into thinking about the location of the problem, or seeing disability as something that needs

to be fixed, and just seeing disability as part of natural human variation'. Thus, teachers adopt an empowering view of disability.

Some participants, however, indicated that UDL has not fully addressed equity issues and the question of discrimination. Nevertheless, they point out that UDL is not cast in stone. Progress is already being made to address systemic challenges and identifying ways that the current model of UDL can be adapted, including whether it needs broadening.

6. Challenges and potential

While there is strong recognition of the potential for UDL to support inclusive education in LMICs, this is tempered with an understanding of challenges, some of which are not unique to LMICs. Any change process needs to start with a change of mind-set, which can be likened to 'trying to turn a ship that has been moving in a particular direction for a few hundred years'. Teachers are not being trained for current and future contexts: 'We are still trying to train children for the industrial age so we are about 60 years behind.' It is not enough and it will not be effective to implement changes at policy level only. Rather, these changes need to 'percolate right to the grassroots level, into every single classroom'. The need for a change of mind-set is apparent across a range of contexts:

The challenges are not so different from country to country. The biggest challenge is the traditional way of thinking with a medical model focus – money and resources being put into purchasing expensive equipment to test children, focusing on IQ testing.

It was suggested that this challenge may be greater in high-income countries that are more rigid, such as 'in Germany where the children have to fit in a cemented system', whereas 'some of the indigenous communities are actually more often receptive to new ideas and approaches because their systems are not so rigid and bureaucratic'. A change process in which teachers gain confidence to explore new strategies and are supported to use their own creativity is needed. That said:

Getting teachers away from textbooks makes them insecure as it forces them out of their comfort zone. Teachers find it

challenging to get creative and design assessments in a more creative way.

A key strategy for teacher education was identified in introducing UDL concepts:

The teachers need to understand what UDL is. What's the essence behind it? What are the principles behind it? That is the challenge, to deliver the message that inclusive education is about good education for all children, and it doesn't matter if they have disability, whether it's girls, boys, etc.

One of the major concerns was the role of technology in UDL, as participants noted a 'growing association of UDL with technology and how relevant that is across different contexts'. However, this reflects a misconception around technology as UDL is not a guide on how to use technology but rather how to design instruction. As already noted in theme 6, technology can support this, but it is not always needed. It can also be low- to mid-level tech rather than automatically implying high tech. However, it was acknowledged that increased access to and use of technology is critical, especially in the COVID-19 context. UDL can support the integration of technology into teaching given its pedagogical strategies. This can be especially critical for students with disabilities who require assistive educational technologies 'yet so many lower- and middle-income countries are still facing very strong challenges just around basic accessibility of educational materials for students with disabilities'. While lack of resources is a very real problem, it should not be used as an excuse not to begin the processes of change:

That is the excuse that we always use in Africa, that we don't have resources and I always say, 'Come on, the first resource is you.' All other resources will fall into place. But the first thing is the political will.

The implementation of UDL is hampered by generally weak systems of teacher education. Pre-service education programmes may not develop a strong 'pedagogical base', making it 'hard to build on top of that, with UDL'. This creates the concern that UDL may 'become an elite thing that's only accessible by those who are on the wealthier rungs of the socio-economic ladder'. Where access to education is weak, UDL may be seen as a luxury and not a priority and 'where systems are perhaps focused more on different issues':

If there are high overall out-of-school rates then oftentimes they're saying we're not thinking about children with disabilities. Yet we're just thinking about, you know, we have 40% out-of-school rate or whatever.

Given the multiple demands on the education system and on teachers, 'sometimes UDL just feels overwhelming because it feels like one other thing that we're asking teachers to think about'. This implies that teachers need support to appreciate:

... how UDL can be actually seen as almost like an umbrella and that it's a way to kind of organise some of the other initiatives that are taking place at your school. And so that it doesn't need to feel like one other thing, but that it's going to kind of be a framework for addressing some of the other goals that you have.

In this way, UDL can be used as an organising approach that is complementary to other efforts being made by teachers, and not as an extra thing that educators are asked to do.

Making that explicit and trying to make connections between UDL and some of the other initiatives or other goals that are happening at a school or at a district is really important to just make teachers and administrators feel more comfortable ... getting on board and wanting to learn more.

Another challenge is the focus of UDL, which is closely linked to inclusive education and, by extension, a particular understanding of inclusive education linked to disability. This represents UDL as a niche need when 'in fact for UDL you're looking even beyond just children with disabilities to looking at all levels of marginalisation'. The potential of UDL for systemic change can only be realised where its application is system-wide.

The system level is a challenge, the government uptake of yet another approach [is a challenge]. Let's move from special schools to resource centres to reasonable accommodations and now UDL. The challenge is for ministries to take up and understand the importance of UDL, and then it trickles down to implementation.

Beyond initial teacher education are the twin challenges of ongoing educator support and monitoring outcomes, necessitating the development of 'capacity

and resources and tools to be able to measure the effectiveness of UDL'. Resourcing a system-wide change tends to encounter 'a big pushback at the level of the financing, when we talk to governments', which express a willingness to implement, but shy away from the additional resources they see this will require. To address this, countries can be directed to look at 'existing financing mechanisms and existing pockets of resources, and how within that you can be able to integrate UDL beyond just saying "do UDL"'. This implies the integration of UDL not only in teacher education, but also in resourcing plans. Although governments indicate interest in UDL, it has not yet reached the point of being an educational priority.

The potential for UDL to support inclusive education resonated throughout our interviews, particularly in the way that the UDL framework has taken evidence and evidence-based practices and made them actionable for teachers and educators. The inherent power in the combined rigor and flexibility of the UDL framework provides immense potential for supporting greater inclusion and more inclusive educational practices around the world.

Key points

- UDL is seen as a tool to support the achievement of the SDGs in its response to diversity, and answers the call to 'leave no-one behind'.
- A feature of UDL is that it enables thinking at a systemic rather than an individual level.
- The concept and practice of UDL principles is not unfamiliar.
- Inclusive education and UDL cannot exist independent of each other. UDL is seen as an instructional approach that provides an operational framework to implement flexible teaching in inclusive education.
- UDL was not only identified as a framework, but also as a theory or philosophy to inform inclusive education.
- UDL helps educators to move from a medical model of disability to a human rights, diversity and inclusion perspective.
- Practical training has to be bolstered by evidence of successful implementation of UDL.
- UDL needs to be included in policy for designing pre-service teacher training and not be added as an afterthought that requires costly adaptations to the system.

- The levels of and requirements for teacher training are very diverse in different contexts.
- Getting teachers to move away from the 'traditional ways of doing things' is a big challenge.
- A systemic approach to teacher training in LMICs is lacking.
- Training needs to be a process that is accompanied by a plan and ongoing support.
- The involvement of government authorities and policymakers is crucial for financing and sustaining UDL training programmes.
- Teachers need to be aided to understand that UDL is not all about technology.
- Teacher training can be enhanced through blended learning.
- The introduction of UDL in LMICs is frequently initiated through international collaboration.
- Capacity building of teachers needs to be approached through a social model lens, be supported by families and communities, and address digital literacy.
- Training materials need to be repackaged for online delivery and downloading.
- Although governments indicate interest in UDL, it has not yet reached the point of being an educational priority.

4. Discussion and recommendations

In presenting our recommendations we go back to the terms of reference set for this study: to review current practices of UDL in LMIC setting with a view to forming recommendations for capacity-development resources and materials. The purpose of this report was to explore how UDL is currently being applied in LMICs in order to inform the development of relevant and effective capacity-building for its implementation in these countries. In this section we will briefly highlight the main findings from the review of OERs before making recommendations. Each recommendation will be presented with a justification and suggestions for how it might be implemented.

Findings from the review of OERs

A review of OERs for UDL was carried out with the goal of identifying OERs applicable to LMIC contexts. A Google search was conducted using the terms 'Universal design for learning' OR 'UDL' from 26 January 2021 at 13:00 (SAST)

to 17 February 2021 at 13.39 (SAST). The initial Google search yielded 8,410,000 results. The results were reviewed for OERs that are relevant to LMICs. This entailed going from page to page through the Google search results. After the fifth Google search page, signs of data saturation appeared when similar patterns of OERs started to show. The following patterns were identified:

- Most OERs are from the global North.
- Very few OERs are tailored for LMICs.
- A significant number of OERs are for tertiary levels of education.
- Some OERs focus on the corporate world.
- A significant number of OERs include examples of UDL practices.
- Some OERs offer a summary of UDL (particularly the principles), then refer the reader to other OERs (mostly by CAST).
- Some OERs are presented using UDL principles.

The total number of identified OERs was 52. The content of the OERs was further analysed in terms of quality, principles and practices of UDL, and relevance to LMICs. This led to the selection of 10 OERs that are most relevant for educators in LMICs (Appendix 2).

Recommendations

1

Capacity building for UDL should be grounded in, informed by and adapted to broader educational philosophies and approaches that are relevant to the context of implementation.

UDL as a term and as a conceptual framework is not widely used in LMICs, but is espoused enthusiastically by those who are aware of it. There is clear recognition that it should not be imported into new contexts without a thorough understanding of educational practices in general and those practices that address learner diversity specifically within that context. Both the literature and the interviews reveal that anchoring UDL within broader educational philosophies such as Confucianism (China), Ujamaa (Tanzania) or other African philosophies, including *Ubuntu*, will not only make it more acceptable, but also enrich the way in which we understand diversity globally. A participatory action research approach to implementation offers the potential for bringing in indigenous knowledges and frameworks.

While much of the initial impetus for the implementation of UDL comes from the global North, this support is more effective when it is embedded in a partnership with knowledgeable practitioners based in the learning context. There are different meanings attached to 'inclusion' and 'UDL' in global settings. This approach would view currently marginalised groups as having a form of expert knowledge about issues related to schooling and inclusion, rather than a deficit or gap in knowledge about the way these concepts are defined and practiced in Western settings.

Capacity development should aim to leverage the knowledge and strengths that already exist in these contexts, and assist educators to identify ways in which UDL can further strengthen existing practices.

2

The implementation of a training programme needs to take into account possible resistance from teachers on the grounds of the material realities of large classrooms and difficult working conditions.

Teacher education should start with an understanding of the context in which teaching takes place. Similarly, examples and material should reflect these realities while highlighting possible strategies to implement UDL in the face of multiple barriers. The implementation of UDL should be seen as an ongoing process of incremental steps, rather than a once off event.

3

Blended course delivery models for teacher education should be developed that balance in-person teaching with online teaching according to the context.

Blended learning allows for the benefits of both in-person and online instruction. The balance between the two may be variable depending upon access to software, data, devices and so forth, as well as the availability of trainers, accessibility of meeting venues, cost of transport to central meeting points, etc. Thus, the balance between the two modes of delivery should be decided according to context, needs and available resources. The importance of online learning means that teachers have an opportunity to develop their digital literacy. This enables them to access learning and support from a range of sources, taking agency over their own learning and becoming empowered

educators. Furthermore, teachers need to develop and build their own digital learning skills so that they can pass these on to their learners who will need these skills to be successful in the 21st century. Finally, the implementation of UDL can be enhanced when the array of learning resources available online can be utilised. However, the low penetration of digital learning in many LMICs means the in-person options remain important. These face-to-face meetings will provide support for digital learning and can be tailored to address the particular difficulties teachers may have with access to data and devices. For example, training might take place at a meeting held at a close but central point with a trainer who can take teachers through online activities. At the same time, hard copies of resources should continue to be provided as teachers might not always have access to devices to view relevant documents.

4

There needs to be rigorous research on the impact of teacher education in UDL on the learning outcomes for children.

Teachers are not trained to implement UDL. There is no evidence of any pre-service training, which is a major concern if UDL is to be implemented systemically. In-service professional development activities have been undertaken largely with the support of researchers from high-income countries. The impact of these courses has not been measured in a systematic way and there is no data to compare different training programmes in terms of the balance between online and in-person, involvement of senior education officials, family involvement, ongoing support and other possibly relevant variables. Such research should explore cost effective teacher-education programmes within the overall teacher-education system of a country.

5

Capacity building should aim to develop not only UDL skills, but also leadership in UDL that empowers local educators to adapt and use UDL within their own contexts.

The concepts of disability, diversity, UDL and inclusive education are not understood in the same way globally, therefore the way in which these concepts are linked may vary from one context to another. Linking UDL to a narrow definition of inclusive education often has the negative consequence of seeing

UDL as being only of use for children with disabilities. However, UDL is applicable to every child, taking into account the notion that there is no such thing as the average learner and that every person learns differently. A broad understanding of UDL, as an approach that enables individualised learning, needs to be promoted. If adopted on a wide scale, the practice of UDL can support greater flexibility of pedagogy, increased collaboration, and greater digital inclusion for all learners. UDL can be used to shift educational philosophies away from rigid and exclusionary practices to more flexible and inclusive ways of learning.

The implementation of UDL can only occur in a conducive policy environment. Where high-stakes testing and rigid curricula are not adapted to the diverse needs of learners, it becomes all but impossible to make use of UDL strategies. It is also clear that, while UDL may be mentioned in inclusive education policy, it may not be implemented in a coherent way. Early adopters of UDL who learn from practitioners in high-income countries, for example those trained by CAST, should give advice on how they see UDL being successfully implemented in LMICs. This would promote UDL practitioners who become 'experts' and 'champions' in their own contexts.

6

Recognition of the importance of assistive technology and reasonable accommodations that will be required for children with disabilities.

The application of UDL principles is a necessary step towards creating learning environments that cater for diverse learning needs. However, in line with General Comment 4 of the UNCRPD (2016), it is important to consider reasonable accommodations within this framework. Specific curricula (e.g. expanded core curricula for learners with visual disability), modes of communication (e.g. Braille, augmentative and alternative communication), languages (e.g. sign language), and assistive technologies (e.g. smart phones or laptop computers) are required to ensure full participation of children according to their individual needs, as well as those with severe or complex disabilities. This implies that teacher education in UDL should consider how these accommodations are dealt with in regular classroom pedagogy through the use of UDL planning methods. It also requires teachers to have at least some

knowledge of the impact of impairment on learning styles, teaching strategies, and accommodations. In order to achieve this, earmarked funding is required to support educational planning that is underpinned by universal design involving multi-sectoral, multi-stakeholder and multi-ministerial parties. Engagement with persons with disabilities is critical in planning the assistive technologies and reasonable accommodations required. Data from health and education management information systems and ministries of finance can inform budgets required to support such provision. Similarly, infrastructural development should plan for the accessible provision of public services, while human resources plan for the provision of the education workforce that will be required.

7

Promote family and community involvement in the implementation of UDL.

This review highlights the neglect of an important resource: families and communities. Frequently in the literature, the family or community is portrayed as hostile and unsupportive of diverse learning aims and outcomes. However, in our interviews, it became clear that the implementation of UDL to promote inclusive education could only be successful where communities and families are part of the process. UDL in the neighbourhood school is a wonderful thing that children with disabilities will often not benefit from if community workers are not motivating parents to enrol their children and working with community leaders to break down the financial, transport, attitudinal or structural barriers that keep children out of school. It is therefore important not only to reduce stigma where this prevents children from accessing schools, but also to build upon existing community assets to achieve maximum impact. Families need to be supported to advocate for their children and to engage in enhancing their children's learning and development. The formation of inclusion committees that will be formal 'check-in' structures that monitor the progress and sustainability of UDL strategies and uses of technology could also be helpful (Damiani, et al., 2016). Community based inclusive development (CBID) empowers community members and community-based organisations to take collective action for achieving disability-inclusive development in their communities. Partnerships between schools and communities is a principle that underpins this approach.

We have not fully explored the power of UDL to address systemic inequality, but there are indications that the proactive approach to diversity could be effective in building inclusive, quality and equitable education. While there is recognition that inequities arising from disability might benefit from UDL interventions, the lack of an intersectional perspective means that other forms of diversity are neglected and disability is emphasised. By focusing on the learning environment, rather than embodied or attributed qualities of the child, equality of opportunity is created. However, the creation of such an environment might be hampered by ongoing prejudices or assumptions about what a particular group is capable of and entitled to do. Attitudes of teachers to stigmatised groups need to be worked through in a non-threatening way and within the customs and structures of their communities.

A repeated theme in our research, and indeed within inclusive-education research broadly, is that teachers express the need for training. However, where reports of successful implementation of UDL are found, teachers and teacher trainers have empowered themselves through online learning and communities of practice. Online, blended and in-person training opportunities need to be available to teachers so that they can experience a conducive learning environment (which they will, in turn, create for their learners), which gives them a range of options and pathways to developing mastery of UDL. Such training should aim to build confidence and creativity in teachers, and to support their agency and development of support networks. This cannot happen in an environment where teachers are expected to operate within rigid curricula and pedagogies. Empowering teachers to be reflective practitioners will also need to be advocated for in education departments and supported by education officials.

Some countries have access to high-tech solutions, but these are not always readily adapted to students' needs. An impression gained from the literature is that UDL is tied to technology and will be better implemented where such technology is available. However, this is not always the case as the presence of technology seems to be less important than the considered use of available resources by teachers who understand the principles of UDL and responding to diversity. The use of technology has been constructed as a barrier to the implementation of UDL in low-resource settings and seems to arise through a conflation of pedagogy with learning support materials. The pedagogy of UDL is not dependent on technology as it relates more to adopting diverse teaching and learning strategies, irrespective of whether they are technology-dependent or not.

In low-resource settings, there are possibilities of using recycled materials if these are collected and distributed through resources centres. What is more important here is teacher creativity and confidence. This would entail developing and documenting examples of low- to high-tech solutions, so that teachers feel empowered to engage with different levels of technology, knowing that these are effectively applied in UDL and not an inferior stopgap.

At the same time, the significance of technology, especially as it supports digital literacy, cannot be denied in a world impacted by COVID-19 and the imperatives of social distancing. The potential for UDL to use technology, and to build technological capacity and literacy for teachers and children, should be exploited through capacity building that raises levels of digital and technological literacy wherever possible. This is especially important given the lessons we have learned from COVID-19, which has increased the digital divide. Efforts toward achieving equality will not be successful if greater technological access and participation is not pursued. Thus, while accepting the need for low-tech approaches, there should be an effort to build resource capacity in technology provision and use.

Recommendation summary

1. Capacity building for UDL should be grounded in, informed by and adapted to broader educational philosophies and approaches that are relevant to the context of implementation.
2. The implementation of a training programme needs to take into account possible resistance from teachers on the grounds of the material realities of large classrooms and difficult working conditions.
3. Blended course delivery models for teacher education should be developed that balance in-person teaching with online teaching according to the context.
4. There needs to be rigorous research on the impact of teacher education in UDL on the learning outcomes for children.
5. Capacity building should aim to develop not only UDL skills, but also leadership in UDL that empowers local educators to adapt and use UDL within their own contexts.
6. Recognition of the importance of assistive technology and reasonable accommodations that will be required for children with disabilities.
7. Promote family and community involvement in the implementation of UDL.
8. Explore the power and document experiences of UDL to address the fault lines of inequality and stigma in the teaching and learning community.
9. Teachers should be empowered to use creative approaches and take control of their own learning and how to present materials and to engage and assess their learners.
10. Teachers should engage with different levels of technology in the implementation of UDL.

Limitations of the study

- The literature review was a desk review of literature. There could be more UDL practices within LMICs that have not been documented or published and therefore could not be accessed or referred to in this research.
- The literature review was conducted with the goal of mapping out the status of UDL in terms of capacity-building needs in LMICs. Systematic reviews could further expound on the findings, including assessing the quality of the literature.

- The review of OERs used the Google search engine which may be configured to show search results in a particular way. Thus, the findings of the OERs should be viewed with the subjectivity of the search engine in mind.

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Appendix 1: Search terms for scoping review

SEARCH “universal design OR UDL
TERM 1 for learning”
AND

SEARCH “Low middle OR ("Deprived Countries" OR "Deprived Population*" OR
TERM 2 income countr*” "Developing Countr*" OR "Developing Econom*" OR
"Developing Nation*" OR "Developing Population*" OR
"Developing World" OR "LAMI Countr*" OR "Less
Developed Countr*" OR "Less Developed Econom*" OR
"Less Developed Nation*" OR "Less Developed World" OR
"Lesser Developed Countr*" OR "Lesser Developed
Nation*" OR LMIC OR LMICS OR "Low GDP" OR "Low GNP"
OR "Low Gross Domestic" OR "Low Gross National" OR
"Low Income" OR "Lower GDP" OR "lower gross domestic"
OR "Lower Income" OR "Middle Income" OR "Poor
Countr*" OR "Poor Econom*" OR "Poor Nation*" OR "Poor
Population*" OR "poor world" OR "Poorer Countr*" OR
"Poorer Econom*" OR "Poorer Nation*" OR "Poorer
Population*" OR "Third World" OR "Transitional Countr*"
OR "Transitional Econom*" OR "Under Developed Countr*"
OR "under developed nation*" OR "Under Developed
World" OR "Under Served Population*" OR
"Underdeveloped Countr*" OR "underdeveloped econom*"
OR "underdeveloped nation*" OR "underdeveloped
population" OR "Underdeveloped World" OR "Underserved
Countries" OR "Underserved Nations" OR "Underserved
Population" OR "Underserved Populations")
OR (Africa OR African OR Algeria OR Angola OR Benin OR
Botswana OR "Burkina Faso" OR Burundi OR "Cabo Verde"
OR Cameroon OR Cameroun OR "Canary Islands" OR "Cape
Verde" OR "Central African Republic" OR Chad OR Comoros
OR Congo OR "Cote d'Ivoire" OR "Democratic Republic of
Congo" OR Djibouti OR Egypt OR Eritrea OR eSwatini OR
Ethiopia OR Gabon OR Gambia OR Ghana OR Guinea OR
Guinea- Bissau OR "Ivory Coast" OR Jamahiriya OR Kenya
OR Lesotho OR Liberia OR Libya OR Madagascar OR Malawi
OR Mali OR Mauritania OR Mauritius OR Mayotte OR
Morocco OR Mozambique OR Namibia OR Niger OR Nigeria
OR Principe OR Reunion OR Rwanda OR "Saint Helena" OR
"Sao Tome" OR Senegal OR Seychelles OR "Sierra Leone"
OR Somalia OR "St Helena" OR Sudan OR Swaziland OR
Tanzania OR Togo OR Tunisia OR Uganda OR "Western

Sahara" OR Zaire OR Zambia OR Zimbabwe) OR (south america) OR (global south) OR (latin america) OR (asia OR ukraine OR russia OR japan)
OR NOT ("High income countr*" OR America OR Australia OR Canada OR New Zealand OR Europe OR "Global North" OR "developed nation*" OR "first world countr*" OR "first world nation*")

Appendix 2: Some useful UDL OERs

Disclaimer: These sites are owned and managed by specific organisations, companies, or individuals and are not in any way under CBM's or UCT's control. CBM and UCT are not responsible for the information or links you may find on these sites.

Citation / URL	Summary	Keywords
<p>About Universal Design for Learning (CAST)</p> <p>https://www.cast.org/impact/universal-design-for-learning-udl</p>	<p>Describes UDL and how it can help make learning inclusive and transformative for everyone. Also presents the UDL principles and has a link detailing UDL guidelines.</p>	<p>[UDL] at a glance Change the world Guidelines Principles</p>
<p>5 Examples of Universal Design for Learning in the Classroom (CAST)</p> <p>https://www.readingrockets.org/article/5-examples-universal-design-learning-classroom</p>	<p>Defines UDL and describes lesson goals and how assignments can be presented. Also illustrates the way UDL promotes a flexible learning environment, regular feedback and accessibility.</p>	<p>What is [UDL]? Goals Assignment Flexibility Access Feedback</p>
<p>Universal Design for Learning in Higher Education (CAST)</p> <p>http://udloncampus.cast.org/home</p>	<p>A website with UDL resources for higher education.</p>	<p>What is [UDL]? Media and materials Course design Guidelines Syllabus Practices Policy</p>
<p>Universal Design for Learning to Help All Children Read (Global Reading Network, USAID)</p> <p>https://www.globalreadingnetwork.net/resources/universal-design-learning-help-all-children-read</p>	<p>Presents a downloadable toolkit with specific instructional techniques using the framework of UDL.</p> <p>The reference for the toolkit is: Hayes, A., Turnbull, A. and Moran, N. (2018). <i>Universal Design for Learning to help all children read: Promoting literacy for learners with disabilities</i>, Washington, DC: USAID.</p>	<p>Principles instructional techniques</p>

Citation / URL	Summary	Keywords
UDL Lesson Builder – Unit Overview Title: Rocks, Minerals, and Soils Pearson pages http://pearsonspages.weebly.com/udl-universal-design-for-learning-unit.html	Presents an example of a UDL lesson plan.	Lesson plan Classroom Principles Assessment Materials
Universal Design for Learning Anne Hayes, independent consultant on inclusive education, UNICEF https://www.accessibletextbooksforall.org/universal-design-learning	Gives an overview of UDL. Discusses use of digital textbooks.	What is [UDL]? Technology Digital textbooks
Universal Design of Instruction (UDI): Definition, Principles, Guidelines, and Examples Cheryl Burgstahler, Disabilities, Opportunities, Internetworking, and Technology (DO.IT) https://www.washington.edu/doit/universal-design-instruction-udi-definition-principles-guidelines-and-examples	Has an overview of UDL, including definition, principles, guidelines, and classroom examples. The DO.IT website has several additional UDL resources.	What is [UDL]? Guidelines Examples
<i>Universally Designed Assessments</i> National Center on Education Outcomes https://nceo.info/Resources/publications/TopicAreas/UnivDesign/UnivDesignTopic.htm	Offers FAQs that describe how to structure assessments using UDL.	Overview FAQs Assessment
Universal Design for Learning (UDL): A teacher’s guide Allison Posey https://www.understood.org/en/school-learning/for-educators/universal-design-for-learning/understanding-universal-design-for-learning	Defines UDL, illustrates how it looks in the classroom and how to use its three principles. Also illustrates how families can support UDL at home and the way UDL can be used during distance learning.	What is [UDL]? Principles Classroom Families Distance learning

Citation / URL	Summary	Keywords
What is UDL? (video) Katie Novak https://www.youtube.com/watch?v=iY9PecIWcWE&feature=emb_logo	A YouTube video introducing UDL by differentiating it from differentiated curriculum. Uses the analogy of UDL as a buffet, not creating individual meals.	Practices Burn out Differentiated curriculum

A further useful resource is CBM's *Inclusive Education Training Guide* (2021), which is available at: <https://bit.ly/3iIzRG4>

Appendix 3: Interview schedule

1. What is your experience of and understanding of UDL?
Have you had any specific training on the topic?
Have you offered any training through your organisation?
2. How do you see UDL as supporting inclusive education?
How do they connect in policy and implementation?
3. What are your views on current inclusive education training initiatives in LMICs?
How can UDL be incorporated into teacher education?
4. What do you think are the training and capacity-building needs for UDL in LMICs?
5. What recommendations would you make for online learning for UDL in LMICs?
How do you envisage these could be resourced?
6. What technology do you think can be used in UDL in LMICs?
7. In what ways do you think that UDL can address equity issues and discrimination?
8. What do you see as the challenges and potential of UDL in LMICs?
9. Is there anything else you would like to share with us relating to capacity building for UDL in LMICs?