

# Protocol for scoping review

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## Usability of eLearning interventions for teachers and child-care workers in Africa: a scoping review protocol

### INTRODUCTION

#### Background to the problem

Only 34 % of children who enrolled in Grade 1 in 2007 (1) successfully completed high school in 2018 (2) in South Africa. One contributing factor to school failure and dropout is that children do not learn the necessary basic concepts needed for transitioning to Grade 1. These basic concepts include numbers, colours, shapes and body awareness. Recent research shows that as many as 50 % of children entering Grade 1 in South Africa do not test ready for school. (3) There are various contributing factors to children not achieving general and academic developmental goals by age 6. Nevertheless, studies point to lack of preschool teacher training as the number one reason why children do not achieve these milestones, even though they attend some form of preschool or day care. Teacher training in necessary basic concepts at pre-school level would begin to address this problem. (4–6)

<sup>8</sup> The Occupational Therapy Practice Framework: Domain and Process (OTPF) (7) guides the scope of occupational therapy services within early childhood settings, especially as it pertains to school readiness (8). When school readiness is the outcome, occupational therapy services can focus on the cognitive and communication developmental areas. The role of the occupational therapist will then include promotion of basic concepts, such as attending to objects, sorting and classifying objects, and sequencing tasks to complete learning activities. When focusing on performance areas, fostering the development of pre-academic skills will be included for school readiness. Intervention can be directed at either the learners themselves, or the training of teachers and caregivers to reach these outcomes. (7,8)

eLearning/mLearning (which includes online learning and mobile <sup>11</sup> learning) has become more prevalent in recent years. According to the GMSA Mobile Economy report of 2018 (9), cell phone penetration rates are at 44 % for Sub-Saharan Africa, which means almost half of the population owns or has access to mobile devices. mLearning could be an affordable, accessible and usable format of training for early childhood education teacher training <sup>9</sup> that has the potential to improve the quality of teaching for all preschool children. This is especially important for those teachers/day care providers who live and work in resource constrained communities, or who teach children who are growing up in poverty. Six out of every 10 children in South Africa live in poverty, which puts them at increased risk for not reaching developmental goals, such as school readiness. (4,9,10)

Usability testing is one step in the cycle of developing eLearning or mobile curriculum. The cycle includes designing, testing and implementing results until design and usability goals are met. (11) Usability studies include various features that measure the quality of an online product or application. Usability has nine generic attributes, namely learnability, effectiveness, efficiency, comprehensibility, learning performance, satisfaction, simplicity, memorability and errors. (12) Davids et al. (13–15) emphasise the need for proper evaluation of online training programs, which includes heuristic evaluation of the design and process of development, to ensure that the intended learning outcomes are reached. The intended learning outcome of mLearning for day care providers, is an increase in knowledge of teaching the basic concepts necessary for school readiness. Therefore, proper evaluation of mLearning programs are essential. (11–14)

In 2017, Ackerman (16) published the results of data analysis from a US-based, online child-care training provider to investigate who participates in online training for child care workers, what the focus is of the training being offered and which topics show higher participation rates. It was determined that online training meet the needs specifically of child-care workers who lacks in-person training options due to high cost of programs, geographical accessibility constraints, work obligations, or who prefer the convenience of learning at their own pace in their own homes. Of the courses offered in 2016, roughly 75 % were at a beginner level and one hour in duration. The current online training format and level of training aims at increasing knowledge, whereas intermediate and advanced level training is needed to improve teaching practices as well as improve the learning outcomes of the children. (16)

### **Aim and objectives**

In preparation for developing a mobile application to teach basic concepts, we want to understand the key factors that influence design and usability of eLearning programs for day care providers in LMIC such as ours.

The objectives of this scoping review are three-fold. Firstly, to summarize and map the available peer reviewed literature on eLearning and online training for child-care workers in LMIC in the last 10 years. Secondly, to identify research gaps within usability studies for eLearning and online training of child-care workers in LMIC. Lastly, to make recommendations for future usability studies for eLearning and online training of child-care workers in LMIC.

### **METHODS AND ANALYSIS**

Arksey and O'Malley (17) developed a methodological framework for scoping reviews, with additional recommendations for each stage suggested by Levac, Colquhoun and O'Brien (18). We will follow the

Arksey and O'Malley (17) framework to complete the scoping review and the PRISMA extension for scoping reviews (PRISMA ScR): Checklist and explanation (19), will be used to complete the write-up of this scoping review.

### Stage 1: Identifying the research question

The research question was developed with our target population and context in mind, but also stated as broadly as possible, as to not exclude any relevant studies.

The question is: *What is known about the usability of mobile or eLearning interventions, that improve the knowledge, skills and attitude among child-care workers in LMIC, to promote early childhood development of 3-6-year olds?*

### Stage 2: Identifying relevant studies

The search will include three phases, namely: a database search, hand-searching of relevant journals and screening of reference lists of already included articles in previous phases.

We chose ERIC, CIHNAL, Africa-Wide Information and Academic Search Premier as relevant databases for the search. These include research in the field of education, allied healthcare professions, and research conducted in Africa.

We selected the parameters to limit our search to studies published in peer-reviewed journals, in English, between January 2009 and January 2019. Development of hardware and software are a continuously changing landscape, therefore, only the last 10 years of published research will be considered for this scoping review. This timeframe also coincides with the emergence of smartphones within the African context.

After considering our research question, we developed the following terms in consultation with a librarian in order of inclusion importance. These will be included in the systematic search:

1. "early childhood development" OR preschool OR teacher OR day care
2. train\* OR teach\* OR learn\*
3. e-learning OR mlearning OR online OR mobile
4. Africa OR LMIC

Once the initial search is done, duplicates of exact results will be automatically removed by the search engine.

Once the total unique studies are identified using our search string, results will be uploaded to COVIDENCE, a review management software. The first reviewer will consider all the titles against the

inclusion and exclusion criteria as described in Table I, after which selected articles will be included for the abstract screen.

Technology journals, will be hand searched using the same parameters and key-word combination, and additional articles will be selected for abstract screening.

INSERT TABLE I. ABOUT HERE

### **Stage 3: Study selection**

The first reviewer will complete the next phase by reading the abstracts, considering <sup>2</sup> the inclusion and exclusion criteria and selecting articles for full text reading. It is important to note that this is part of an iterative process and as inclusion and exclusion criteria develop, studies will be added or eliminated.

Both reviewers will complete the next phase of full text reading. Studies that meet all <sup>14</sup> the inclusion and exclusion criteria in this phase will then be added to the final list of articles for this scoping review. All reference lists of studies selected for final inclusion will be scanned for additional articles that may meet our inclusion criteria. These articles will be reviewed and included if appropriate. The Covidence software will be used to maintain an audit trail of all decisions made for inclusion and exclusion by each of the reviewers. The software will also generate the final PRISMA flow diagram indicating the various stages of article review.

### **<sup>1</sup> Stage 4: Charting the data**

The reviewers developed a data-charting form, using Excel. Data will be extracted on characteristics of the population, the methodology and the results and recommendations. Table II presents a preliminary set of information that will extract from each study. As we are using an iterative process, the data-charting form may be modified as we proceed through the data extraction process and more information is available from each study. During the data extraction and charting process, it is once again very important to reflect on the research question and focus on data from each study that will shed light on the design and usability of the eLearning programs used by the intended population.

INSERT TABLE II: ABOUT HERE

### **<sup>7</sup> Stage 5: Collating, summarising and reporting the results**

Results will be reported in a descriptive and narrative summary. We will report on the demographic description of the population, as well as which geographical areas within Africa in which research has been conducted. Other areas of focus for reporting the results will be on the quality of the research included, as well as trends in the frameworks and models used to inform these studies. To answer the



research question, the analysis will mainly focus on the usability aspects of training programs for child care workers in LMICs. Where possible, the recommendations for good design evident in each article will be clustered into the 9 attributes of usability. The findings of the scoping review will be published in an article, as well as inform the design and usability considerations for further research on development of a mobile training program for child-care workers in a LMIC.

### Study timeline

The study timeline described in table III includes the process for both the scoping review protocol article and the write up of the results in a follow-up article.

INSERT TABLE III: ABOUT HERE

### Patient and public involvement

The scoping review protocol and the review to follow on this protocol, does not require the participation of the general public, or of any patients.

### DISCUSSION

According to the OTPF (7), the teaching of basic concepts and working towards school readiness for pre-schoolers, are fundamental to occupational therapy services in schools and in private practice. This service can be delivered on an individual basis or be directed at the training of child-care workers and caregivers. To make this training accessible and affordable child-care workers and caregivers, especially in resource constrained areas, eLearning and mobile learning products must be considered and evaluated in its effectiveness.

Authors like Davids et al. (13–15), emphasised the need for proper usability studies and heuristic evaluation of mLearning products, to ensure that the learning outcomes can be achieved by the intended population. This scoping review is necessary to assess what is known about the usability aspects for mLearning products used by day care providers for their own formal learning or professional development. As discussed previously, this scoping review will help summarize the current peer reviewed literature, identify the research gaps within usability studies and inform future design and usability, as applicable on mLearning products for child-care workers in LMIC's. The results of this scoping review will also form part of the literature review for the development and testing of a mobile application to train child-care workers to teach basic concepts, all within a LMIC context. (11–13)

Existing literature published in the last 10 years will be analysed and therefore, ethics approval was not required. The scoping review protocol and publication of the protocol is an important step in this scoping review, <sup>12</sup> to ensure transparency and reduce duplication of work.

It will be useful to determine what is known about the design and usability of mLearning product used by child-care workers in LMIC's and how successful these are in influencing skill, knowledge and attitude in teaching practices. Mobile learning in general is an affordable, accessible and convenient method for formal training and professional development and should be informed by research to move forward with successful outcomes.

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ADDENDUM A: TABLES

TABLE I: Inclusion and Exclusion Criteria

<u>Inclusion Criteria</u>
<ul style="list-style-type: none"><li>• Training child-care workers (pre-school teachers for 3-6-year olds, including grade R and Foundation phase)</li><li>• Mobile learning element</li></ul>
<u>Exclusion criteria:</u>
<ul style="list-style-type: none"><li>• Training of other than ECD or foundation phase teachers (3-6-year olds)</li><li>• No eLearning element</li><li>• Study not in Africa or LMIC</li><li>• Study not published in English</li><li>• Training of teachers for skills other than attitude, knowledge and skill of early childhood curriculum</li><li>• Using technology to teach children</li><li>• Children using the technology</li></ul>

TABLE II: Data extraction sample worksheet

<b>Source</b>	Name of article		
	Author		
	Date published		
	Journal		
<b>Population</b>	Geographical Area	<b>Methodology</b>	Method
	Teaching Context		Methodology
	Number of participants		Level of Evidence (20)
	Age of participants		Outcome Measures used
	Training program		Design model or framework used
	Age of children being taught		Topics taught within ECD
	Level of teacher training		mLearning/eLearning/Video
	Type of program		Language used
<b>Recommendations</b>	Usability	Learnability	Satisfaction
		Effectiveness	Memorability
		Efficiency	Simplicity
		Comprehensibility	Error
		Learning performance	Contextual Relevance

TABLE III: Study timeline

<b>Stage 1: Identifying the research question</b>	We have already developed and identified the research question, in order to reach an objective of identifying relevant research to support and inform the development of a mobile learning product for training child-care providers.
<b>Stage 2: Identifying relevant studies</b>	A systematic process will be followed, as described by Bartels (21), to complete a systematic search of the literature. This includes deciding on the databases to include, the search parameters and the keywords.
<b>Stage 3: Study selection</b>	We will use Covidence to assist us in the systematic process of study selection. This allows for both researchers to be included and given access to the relevant studies at the relevant stages as decided beforehand. The title screen and abstract screen will be completed by the first reviewer only. The full-text screen will be completed by both reviewers. Title screen and abstract screen will be completed in Month 1 and 2. The full-text screen will be completed in Month 3.
<b>Stage 4: Charting the data</b>	As studies are identified to be included, the data extraction process will commence. The data extraction worksheet (table I) will be used and will also expand during this iterative process from Month 4 to 6. Framework analysis will be used to extract and chart the recommendations. The usability framework consists of nine attributes, according to the international standards for systems and software engineering. (22)
<b>Stage 5: Collating, summarising and reporting the results</b>	The descriptive and narrative summary of the data will be presented in a second article and submitted for publication in Month 9. Framework synthesis will be utilized as a structured approach to organize and analyse our data. (23) Once the relevant information is used to answer the research question, the information will be used to form the basis to inform the design and usability aspects of a mobile training application to train day care providers.

# Protocol for scoping review

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