Review

The Applicability of eLearning in Community-Based Rehabilitation

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Abstract: Community-based rehabilitation (CBR) strives to enhance quality of life for individuals with disabilities and their families by increasing social participation and equalizing opportunities in the global south. Aligning with the Sustainable Development Goals, CBR also aims to address the high rates of poverty faced by individuals with disability. Empowerment, a pillar of CBR, involves strengthening the capacity of people with disabilities, their families, and their communities to ensure reduction of disparities. This article outlines a scoping review that guided by the question: "What is known from the existing literature about the applicability of eLearning for capacity building in CBR?" This review did not uncover literature related to eLearning in CBR; however findings suggest that other disciplines, not explicitly tied to CBR, currently use eLearning to educate and empower professionals in the global south. We argue that eLearning technology could be an effective and sustainable solution for CBR programming in the global south for capacity development. Such technology could increase individuals with disabilities' access to education and could provide opportunities for wider dissemination of knowledge, beyond typical funding cycles. With a goal of informing future CBR practice in eLearning, this article concludes by highlighting key lessons taken from other disciplines that have utilized eLearning in the global south.

Keywords: eLearning; community based rehabilitation; global south; capacity building; sustainability

1. Introduction

According to the World Report on Disability [1], over one billion, or approximately 10%–15%, of the world's population has some form of disability. Individuals with disabilities often experience poorer health, less education and employment opportunities, and are over-represented in poorer countries [1]. As such, addressing global poverty, as well as the disparities among people with disabilities, must go hand in hand. The Sustainable Development Goals (SDGs), the new development agenda after the Millennium Development Goals, highlight disability in its goals to eliminate global poverty by 2030 [2].

In developing countries, it is estimated that 80% of individuals with disabilities live in isolated rural areas in developing countries [3]. By increasing support systems for people with disabilities through community development and building the capacities of members of the community, people with disabilities may have a better chance at equal opportunity and improving their quality of life. Since the 1970s, the international community has promoted community-based rehabilitation (CBR) as an important strategy to bring education and services to communities in which these are lacking [4]. Aligning with the post-2015 development agenda, CBR aims to enhance the quality of life of individuals with disabilities and their families by increasing social participation, equalizing opportunities, and addressing the high rates of poverty. Inherent to the principles of CBR is the necessity to focus poverty reduction efforts on people with disability to eliminate global poverty.

The CBR matrix has five pillars: health, livelihood, education, social, and empowerment [4]. Each pillar is integral to the success of implementing CBR projects. This scoping review puts focus on the empowerment pillar of the CBR matrix. The empowerment pillar emphasizes the importance of strengthening the capacity of people with disabilities, their families and their communities to ensure the reduction of disparities [4]. As it relates to the empowerment pillar, we argue that electronic learning (eLearning) could be a potential solution to long-term and sustainable capacity building of people with disabilities, families, and communities to ensure full inclusion of people with disabilities in all aspects of life. eLearning is becoming frequently used as a method of delivering education [5]. Such technology could decrease costs associated with engaging outside experts in content delivery and could provide opportunities for wider dissemination of knowledge, beyond typical funding cycles.

With this article, we outline the results of a scoping review that we conducted to explore the role of eLearning as a sustainable option in CBR for developing capacity in the global south. The scoping was guided by the research question: What is known from the existing literature about the applicability of eLearning for capacity building in community based rehabilitation (CBR)?

Conceptualization of Terms: "eLearning", "Global South", and "Sustainability"

For the purpose of this scoping review, we have conceptualized the following terms in order to delineate the ideas we used: community-based rehabilitation, eLearning, global south, and sustainability.

Community-based rehabilitation (CBR). CBR is most commonly defined as "a strategy within general community development for rehabilitation, equalization of opportunities, and social inclusion of all people with disabilities...implemented through the combined efforts of people with disabilities

themselves, their families and communities, and the appropriate health, education, vocational, and social services" [6]. For the purpose of this study, we will be defining CBR as such.

eLearning. With the uptake in use of non-traditional methods for education, several experts and organizations have defined the concept of eLearning. The Organisation for Economic Co-operation and Development (OECD) defines eLearning as the "use of information and communications technology (ICT) to enhance and/or support learning in tertiary education [which] covers a wide range of systems" [5]. As well, as part of an international project involving experts around the world, Sangra, Vlachopoulos, and Cabrera created an inclusive definition of eLearning, being:

> an approach to teaching and learning, representing all or part of the educational model applied, that is based on the use of electronic media and devices as tools for improving access to training, communication and interaction and that facilitates the adoption of new ways of understanding and developing learning [7].

Although the above definitions provide a comprehensive understanding of eLearning, for the purpose of this scoping review—which was to get a broad sense of how technology is being used for education delivery in the developing world, we chose to broaden our definition of eLearning even further, to include any information and communication technology (ICT) or any web-based learning including interactive online modules, video teleconference, live support, web-based workshops/seminars, electronic medical libraries, online consultations, computer-assisted instruction, distance education, virtual education, learning management systems, or simulation-based learning. In our conceptualization of eLearning for this review, we also included offline computer-based learning delivered through CD-ROMs and USB sticks, as well as mobile learning, or mLearning, which involves retrieving information and resources over a cellular network.

Global south. For this study, we focused on studies that targeted learners in the global south, which we define as developing countries of the Southern Hemisphere, comprising of Africa, Central and South America, developing Asia, and the Middle East [8,9]. In literature, terminology to describe geographically under-developed areas is frequently contested [10]. For the purpose of the study, "global south" will be used to encompass the terms "developing countries" and "low- and middle-income countries", as well as other similar terms.

Sustainability. One of the most commonly cited definitions of sustainability is from the Brundtland Report, which defines sustainable development as, "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." [11]. "Sustainability" can mean many different things in CBR practice. For example, Helander describes sustainability in CBR as a multifaceted concept comprised of three disparate components of sustainability; technical sustainability, which is the program implementation and translation; cultural sustainability, which is the incorporation of the program into the community; and financial sustainability, which is the independent preservation and implementation of the program set in place [12]. Furthermore, Khasnabis and Motsch qualify sustainability as having three elements; technical, financial and organizational, and it must, "be sustainable beyond the immediate life of the programme, that is being able to continue beyond the initial intervention and thrive independently of the initiating agency" [13]. These two concepts indicate the vast ideas that need to be considered when taking into account the idea of sustainability. Due to this diversity in conceptualization of "sustainable" in CBR, for this scoping

review, we did not assign a concrete definition of sustainability, rather, we chose to examine the term "sustainability" in the context in which it is used—thus, one aspect of our results and discussion will include a reflection upon how sustainability was conceptualized in the articles retrieved for this review.
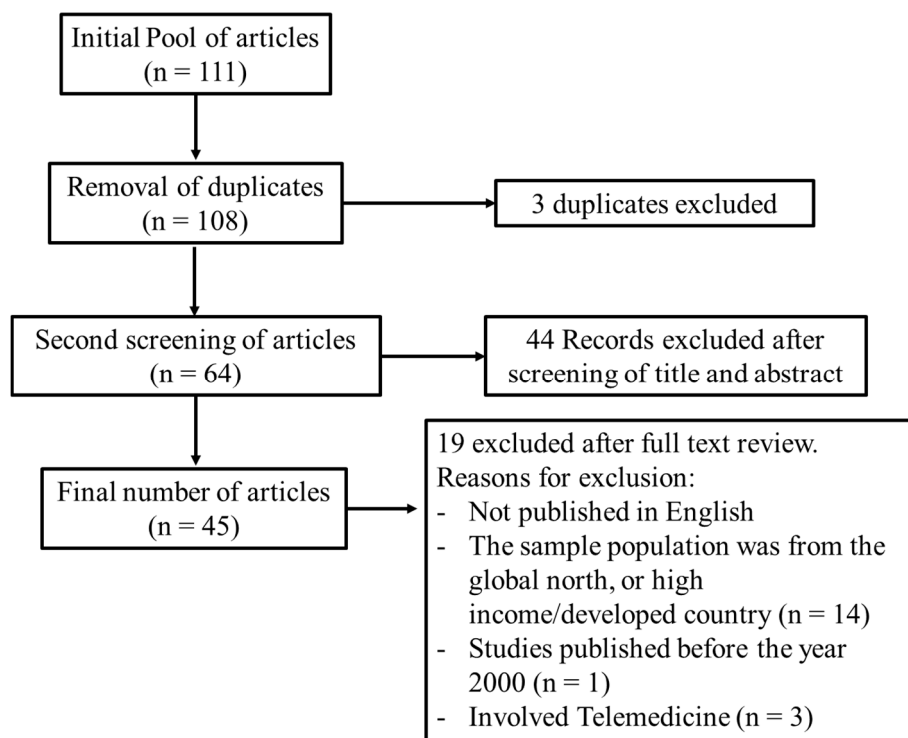
2. Methods

We managed this review from the approach defined by Arksey and O'Malley [14]. Specifically, we conducted this search in a multi- step, iterative fashion. First, we conducted a targeted search to look exclusively at the application of eLearning for community-based rehabilitation in the global south. We used Queen's University's academic search engine which encompasses numerous academic databases including CINAHL, Cochrane Library, Global Health, Google Scholar, MEDLINE, PubMed, and Summon (Queen's University Libraries). Search terms included: "community-based rehabilitation", "capacity building", "global south", "web-based education", and "E-learning". These specific phrases were searched independently and combined using connecting words. Synonyms were searched including, "developing countries", "low-income countries", "middle-income countries", "online learning", "online tutorials", "web-based instruction", "web-based learning", "distance education", and "CBR". From this initial search, we found zero articles meeting our search criteria.

For the second step, we broadened our search inclusion strategy by using the same keywords in the search, except we eliminated "community-based rehabilitation" as a necessary search term. This search yielded 58 articles using the following inclusion criteria: first, articles must discuss eLearning as we have defined it above, and second, articles must place or apply eLearning within the context of the global south. We excluded articles if they were not published in English; the sample population was entirely from the global north, or a high-income country (as classified by the World Bank); or if the article was published before August 2000. We also excluded articles discussing telemedicine as they did not have a definitive curriculum were delivered on a case-by-case basis and therefore did not fit our criteria for "eLearning". Papers were initially screened for inclusion/exclusion based on relevant titles and abstracts. We considered studies from August 2000 to June 2015. We selected 2000 as the cut-off date, as the term eLearning is widely believed to have been coined in 1999 and, thus, the term "eLearning" likely would not have entered into scientific literature before this date [15]. Additionally, we chose the year 2000 as an appropriate cut-off, given the incredible change and expansion of technology over the past 15 years.

For the third step, we hand-searched relevant articles from the reference list of the 58 articles, which yielded another 55 articles, yielding a total of 111 articles. We compiled the 111 articles into a reference organizer (Zotero) and imported the library into to a reference manager (Covidence). We removed three duplicate articles, and two authors then independently read all 108 article abstracts to further screen for the inclusion criteria. We selected of 45 articles for full-text review [16–60] (see Figure 1).

The final step was to analyze the content of the 45 eligible papers to evaluate key themes of the included papers. This was also conducted in an iterative process, with frequent discussions among the three researchers to develop consensus around the most important themes. Specifically, two reviewers extracted data independently and placed the data into a table. The reviewers then compared their data tables and discussed any discrepancies. If no agreement could be reached related to relevant table

content, the third author was consulted and acted as arbiter. This process resulted in information on population sampled, delivery approach of eLearning, workforce, country of implementation, aims of eLearning, and lessons learned/applications being extracted from relevant articles and organized in a detailed table for further discussion.

Figure 1. Flowchart of the studies included in the review.

3. Results

The key themes that we have pulled from selected articles relate to descriptive characteristics, benefits of eLearning, challenges of eLearning, and suggestions for future application of eLearning (see Tables 1–3).

Table 1. Summary of findings from 13 peer-reviewed review studies of eLearning in developing countries.

Author, Date	Context, Setting		Aims	Target Population	Delivery Approach
Dhanarajan, 2001 [16]	Worldwide	(1)	Summarize the causes for the failures, and warns that increasing commercialization and advancing technology of distance education risks the loss of "our sense of equity and quality of opportunities"	General	Distance education and open education
		(2)	Highlights 10 key issues that need to be addressed		
Ngarambe, Pan, and Chen, 2003 [17]	Rwanda	(1)	Discuss an application, Local College Learning Management System that is sustainable and economical to suit the situation in these countries	Post-secondary population (specifically in urban areas)	LoColms is a web-based asynchronous interactive educational system offering courses by point-to-point protocol, delivered by video- recorded class sessions providing video materials instead of texts/audios to learners are in study centre
		(2)	Improve the traditional form of education by empowering local universities higher- education institutions to supplement their existing programs with resources of a global virtual university		
Aczel, Peake, and Hardy, 2007 [18]	Global south	(1)	Capacity building in eLearning	General	eLearning combination of CD-ROM, DVD, the web, asynchronous conferencing, textbooks and face-to-face tutoring
		(2)	eLearning capacity gaps		
Geissbuhler, Bagayoko, and Ly, 2007 [19]	Mali (collaboration with Switzerland)	(1)	Knowledge sharing across care professionals between experts in different countries	Medicine (Physicians and Care Professionals)	Telemedicine and webcasting interactive courses including presentations and dialogues
		(2)	Developing capacities for the creation, maintenance, and publication of quality medical didactic contents		
Sife, Lwoga, and Sanga, 2007 [20]	Global south (focus on Tanzania)	(1)	Discusses new learning and training technologies considering their pedagogical, cost and technical implications	General (Students)	Review of eLearning including TV, CD, video conferencing, mobile eLearning, world wide web
		(2)	Discusses challenges for integrating these technologies in higher learning institutions in developing countries with examples from Tanzania		
		(3)	Provide best-practice approaches for addressing each of the challenges		
Gulati, 2008 [21]	Global south	(1)	Overview of educational developments in open, distance, and technology-facilitated learning that aim to reach the educationally deprived populations of the world.	General (Children and Adults)	Information and communications technologies (ITCs), review of web-based learning
		(2)	Highlights challenges created by poverty, lack of social and educational infrastructures and cultural issues that restrict educational progress in developing countries.		
Safavi, 2008 [22]	Global south (Case-study in Iran)	(1)	Review of general concepts and components of eLearning programs	General (Engineering, Law and eCommerce Students)	Course material accessible online (voice lecture + PDF text + animations) as well as via encrypted CR-ROM, also includes three face-to-face tutorial sessions and four online virtual tutorial sessions, includes access to eBooks and digital libraries
		(2)	eLearning model and guidelines for developing countries		
		(3)	Case-study of first eUniversity (virtual university) established in Iran		
Andersson and Gronlund, 2009 [23]	Global south		Guide future eLearning in global south (apply challenges found through eLearning in the global north and apply it to eLearning implementation in the global south)	General	Reviewed all eLearning

Table 1. *Cont.*

Author, Date	Context, Setting	Aims	Target Population	Delivery Approach
Blankstein, Dakurah, Bagan, and Hodaie, 2011 [24]	Ghana	Transmission of knowledge to neurosurgical trainees in global south Collaboration with International neurosurgical community to implement successful eLearning	Medicine (Neurosurgery)	Clinical education modules (lectures + case scenarios) Online material followed by online discussion
Richardson, 2012 [25]	Global south	Explores the personalization techniques developed by commercial organizations and applied to web-based learning contexts to show they can inform the development of effective personalized education and training for health care providers globally, and specifically in LMICs	Health Care Workers	eLearning with access to a digital library that can be leveraged to personalize and customize the system of individual users.
Frehywot, *et al.*, 2013 [26]	Global south (focus on Brazil, India, Egypt, South Africa)	Summarize literature on eLearning for medical education in LMICs and present spectrum of tools and strategies used	Medicine (Students) *Includes some post-grad medicine education (nursing, medicine specialty, pharmacy, dentistry, mixed, etc.)*	Review of eLearning applications; blended learning is most common, Others include computer- assisted learning, multi- media software, web- based learning, and eTutor/eMentor
Stepanyan, Littlejohn, and Margaryan, 2013 [27]	Worldwide	(1) Provide a baseline in the current understanding of sustainability of eLearning by carrying out a review of research in the area (2) Synthesizes existing literature that reports key factors affecting the sustainability of eLearning (3) Outlines a review of a broad range of literature in areas broadly associated with sustainable eLearning	General	eLearning
Rasmussen, *et al.*, 2014 [28]	Worldwide (5 of the included studies were from LMIC's)	Demonstrate that offline eLearning can be used to address global health care workforce shortages in developing countries in terms of knowledge, skills, attitudes and satisfaction where resources are limited and locations are remote with poor access to the Internet	Health Care Workers (Students in medicine, dentistry, nursing, psych, physiotherapy)	Offline eLearning (delivered via USB or CD-ROM which run on a PC; included eLearning and blended learning with some use of personal digital assistant device

Table 2. Summary of findings from 30 peer-reviewed empirical studies of eLearning in developing countries.

Author, Date	Context, Setting	Aims	Target Population	Delivery Approach
Zbar, Otake, Miller, Persing, and Dingman, 2000 [29]	Bangladesh, Ecuador, Nepal, Peru, Sri Lanka, and Zambia (collaboration with USA)	(1) Empower local surgeons in the developing world through direct skill-transfer and encouraging academic pursuit. (2) Educates physicians in developing regions of the world by providing them with direct and timely access to their colleagues in more developed countries. (3) Develop a community of surgeons in the global south	Medicine (Students)	Web-based medicine; including written communication with translation software, online record-keeping monthly peer-review of surgical caseload, participation in continuing medical education, online database
de Maio and Ferreira, 2001 [30]	Brazil	Describe and discuss the experience with transforming traditional medicine training course into a web-based course	Medicine (Students)	Web-based course
Vichitvejpaisal, 2001 [31]	Thailand	Compare outcomes of self-learning using computer-assisted instruction software and textbook	Medicine (Students)	Computer-assisted instruction with multimedia programming
Corrêa, De Campos, Souza, and Novelli, 2003 [32]	Brazil	Evaluate a web-based practical course on oral surgery principles and develop manual abilities in order to prepare students for all disciplines that involve manual skills (lab and clinical activities)	Dentistry (Students)	Web-based course in multimedia lab equipped with computers Sound system and TV circuits.
Cragg, Edwards, Yue, Xin, and Hui, 2003 [33]	China (Tianjin Municipality)	Increase capacity for delivery of nursing education in China and develop distance education for nurses living in outlying areas of the municipality	Nursing (Students)	Web-based instruction and audio-graphic teleconference system for outlying sites
Syed-Mohamad, Pardi, Zainal, and Ismali, 2006 [34]	Malaysia	Expand the contribution of the School of Health Sciences, Universiti Sains Malaysia to produce more graduate nurses by offering a nursing degree through eLearning to meet the demand for a labour force that is knowledgeable, highly skilled and equipped with positive values	Nursing (Students and Faculty)	eLearning and suggestion for blended learning
Colt, Davoudi, Quadrelli, 2007 [35]	Mozambique and Mauritania	Determine if the web-based curriculum would complement traditional learning to fulfill need for independent self-learning expressed by students in Western cultures	Medicine (Students)	Web-based curriculum online modules via online open-access website and in hospital delivery via Internet access and CD-ROM, multilingual instructor (participate in maternal language), self-study component
Johnson, Ghebreyohanes, Cunningham, Kutenplon, and Bouey, 2007 [36]	Eritrea (collaboration with USA)	(1) Describes an innovative collaboration between two universities (USA and Eritrea) aimed at increasing the number of qualified nursing faculty in Eritrea (2) Provides key recommendations to other universities considering distance education collaboration to help build nursing capacity in developing countries	Nursing (Faculty)	Distance education composed of asynchronous learning management systems (individuals work off-line connecting to the Internet for only short periods of time)
Khoja and Scott, 2007 [37]	Pakistan	Develop new eLearning resources to meet the needs of preventative medicine education; article discusses limitations and facilitators for successful implementation of eLearning programmes	Health Care Workers (Staff and Students)	eLearning supported by traditional resources
Lu, Lin, and Li, 2009 [38]	Taiwan	Assess the effectiveness of supplementing traditional classroom teaching with web-based learning design when teaching intramuscular injection nursing skills	Nursing (Students)	Web-based course plus traditional classroom lecture

Table 2. *Cont.*

Author, Date	Context, Setting	Aims	Target Population	Delivery Approach
Suebnukarn, 2009 [39]	Thailand	Describes an intelligent tutoring system for clinical reasoning acquisition designed to provide an experience that emulates that of live human-tutored problem-based learning sessions as much as possible, whilst permitting the students to participate collaboratively from varying locations.	Dentistry (Students)	Web-based learning including Intelligent tutoring system with text and graphics providing a rich communication channel compared to human today
Adanu *et al.*, 2010 [40]	Ghana	eLearning to be more effective compared to traditional learning (understand access to computers, use of eLearning and value of material)	Medicine (Students)	Web-based modules of cases, videos/animations and open educational resource library
Gerdprasert, Prukasacheva, Panijpan, and Ruenwongsa, 2010 [41]	Thailand	Develop intrapartum nursing care web-based learning to facilitate students acquisition of conceptual knowledge and performance skills	Nursing (Students)	Web-based; Integration of 5E-model and information technology with the lecture content
Grönlund and Islam, 2010 [42]	Bangladesh (collaboration with Sweden)	How to use existing mobile telephony technical infrastructure to create interactive learning environments which can reach a majority of the population, to be able to include thousands of students, and be sustainable from a resource perspective	General (Students)	TV/video and SMS together with learning management systems for interactive, student-centered, paedology
Nartker, *et al.*, 2010 [43]	Tanzania	Review and assessment of Tanzania's current distance learning programmes for health care workers, as well as those in countries with similar human resource challenges, to determine the feasibility of distance learning to meet the need of an increased and more skilled health workforce	Health Care Workers (Instructors and Students)	Review of all eLearning approaches from low-tech print-based programs too high tech and international videoconferencing
Vyas, Albright, Walker, Zachariah, and Lee, 2010 [44]	India (collaboration with USA)	(1) Assess and share best practices for mobile-supported training and resources to leverage strengths and build capacity across secondary hospital mobile/eLearning networks in India. (2) The model can advance interdisciplinary health training initiatives in developing countries, improving clinical service and health for underserved populations across the world	Medicine (Students and post-graduate fellows)	eLearning, with infield mLearning, to facilitate clinical education and training at remote secondary hospital sites across India
Bhuasiri, Xaymoungkhoun, Zo, Rho, and Ciganek, 2011 [45]	Global south	Identify critical success factors that influence the acceptance of eLearning systems in developing countries	General	Reviewed all eLearning
Gallagher-Lepak, Block, Rojas, Birkholz, and Moran, 2011 [46]	Peru (collaboration with USA)	(1) Alternative method to internationalize and globalize nursing curriculum through an online course between faculty and students in Peru and USA (2) Create an online virtual travel course so a larger proportion of students could have an international experience (3) Develop an awareness of cultural aspects of healthcare in nursing practice in another part of the world	Nursing (Students + Instructors)	Asynchronous online course regarding global health issues and nursing interventions in conjunction with clinical problems Communication in maternal language

Table 2. *Cont.*

Author, Date	Context, Setting	Aims	Target Population	Delivery Approach
Hogan, 2011 [47]	Pacific Islands (Fiji, Solomon Islands, Vanuatu)	(1) Online chemistry course designed to accommodate the cultural needs and learning preferences of Pacific Island Students in Fiji, Solomon Islands and Vanuatu (2) Actively engage students in regions of the pacific with limited access to Internet technology to improve success, satisfaction, analytical thinking skills, and to demonstrate the efficacy of the approach	General (Students)	Problem-based learning online chemistry course including virtual classrooms, weekly discussions, individual activities, team projects, video conferencing via low bandwidth delivery access to tutors, course resources, materials and instructors. Also use of Skype, Blogster, Moodle/Nicenet, Twitter and YouTube.
Maldonado, Khan, Moon, and Rho, 2011 [48]	Peru	Empirically validate a modified unified theory of acceptance and use of technology (UTAUT) model by adding "eLearning motivation" construct in the South American context; try to determine the role of eLearning motivation in the use and adoption of eLearning systems and conversely the effect of technology on student's learning motivation; and to test region and gender as moderators in the model	General (Students)	eLearning
Seluakumaran, Jusof, Islmail, and Husain, 2011 [49]	Malaysia	Use a learning management system (Moodle) to construct an online site to facilitate face-to-face teaching of physiology to medical students	Medicine (Students)	Open source course management system, or virtual learning environment including email, chat, online quizzes and questionnaires, interactive course information, lecture notes, laboratory exercises, problem-solving sessions, audio-visual resources, quizzes, access to useful links
Chang, A, *et al*., 2012 [50]	Botswana	Determine if mLearning promotes self-directed learning and effectively provides high-level on-site educational resources for resident physicians when practicing in remote locations	Medicine (Resident Physicians)	Mobile learning (mLearning) via Android-based mytouch 3G smart phone Submission of cases to local mentors and email/web access
Chang, L, *et al*., 2012 [51]	Uganda	(1) Use the study results to better inform the development of future strategies for incorporating information communication technology into the community-based education and services educational experience in Uganda (2) Report insights which could be beneficial to other similar programs in low-resource settings	Community-Based Education and Services (Students and faculty in medicine, dentistry, nursing, radiography and pharmacy)	Information and communication technology including web-based self-directed learning, web-based resources, mLearning (for research, learning, consultation and collaboration)
Mars, 2012 [52]	South Africa	Describe 12 years of experience at the university of KwaZulu-Natal in education and training in postgraduate medical disciplines, medical informatics and telemedicine with a model to build the capacity in the staff at partner institutions so that they can in time offer their own eHealth academic program	Health Care Workers (Staff and Students)	eLearning via video conferencing of seminars and grand rounds which are recorded then sent to medical schools in Africa that do not have the infrastructure to directly connect

Table 2. *Cont.*

Author, Date	Context, Setting	Aims	Target Population	Delivery Approach
Lira, Felix, Chaves, Fulco, Carvalho, and Zimmerman, 2013 [53]	Brazil	To investigate if eLearning material improves the basal student knowledge level before attending the blindness prevention class and if it helps to fix this information one- month after the class	Medicine (Students)	eLearning including PDF articles and emails
William, Elzie, Sebuwufu, Kiguli, and Bazeyo, 2013 [54]	Uganda	An explorative study to assess the capacity for training institutions to use technology for cascading disaster management skills	Public Health (Faculty)	Web-based open education resource with an interactive CD-ROM
George, *et al.*, 2014 [55]	Worldwide	A systematic review of the effectiveness of online eLearning and to compare eLearning to traditional learning or alternative learning methods	Health Care Workers (Students in medicine, dentistry, nursing, physiotherapy and pharmacy)	eLearning comprised of websites, spaced education, video lectures, and visual concept maps
Lwoga, 2014 [56]	Tanzania	Factors that predict students' continual usage intention of web-based learning content management systems. An exploratory study that examines the constructs of information system success model in eLearning systems in sub-Saharan Africa and presents eLearning success factors that should be of value to higher learning institutions management, eLearning systems, designers and providers, and instructors when planning and implementing eLearning projects in the region and beyond	Allied-Health Professionals (Students)	Web-based learning management systems
O'Brien, and Hardman, 2014 [57]	Bangladesh (collaboration with Australia)	Volunteer Occupational Therapists from Australia to provide training to local staff in Bangladesh in the management of hand injuries and burns since 2006. Aim of study was to explore and describe the volunteer's experience and provide recommendations for future capacity building projects in developing countries that are locally designed, high-quality and sustainable	Occupational Therapy (Clinical Leaders)	Online interactive learning modules culminating with delivery of face to face teaching session with hand therapy focus (blended learning)
Zaheer, Jabeen, and Qadri, 2015 [58]	Pakistan	Demonstrate that eLearning plays a key role in capacity building of students in developing countries and can be used to enhance professional skills in specific disciplines	General (Students)	eLearning including video lectures, hard and soft copy lectures, online learning resources, courseware and learning software

Table 3. Summary of findings from 2 non-peer-reviewed articles of eLearning in developing countries.

Author, Date	Context, Setting	Aims	Target Population	Delivery Approach
Sehrt, 2003 [59]	Global south	Suggestion to connect local communities in developing regions to the Internet to have a positive impact on education and their health systems by making information available locally, improve and accelerate knowledge flow and deliver innovative education models to remote areas. eLearning should be considered as a critical facet of basic development, an alternative medium of capacity building and a means to people's empowerment	General	Web-based learning
World Health Organization, 2015 [60]	Global south	(1) Establish the evidence-base for eLearning concluding that eLearning is likely to be as effective as traditional methods for training health professionals (2) Systematic review of the scientific literature to evaluate the effectiveness of eLearning for undergraduate health professional education	Health Care Workers (Students)	eLearning (the use of electronic media and devices in education to support traditional campus-based teaching or enabling distance learning) Online learning via the Internet, offline learning via CD-ROMs and USB sticks

3.1. Descriptive Statistics

3.1.1. Types of Articles on eLearning

There were three types of articles collected in our scoping review; (i) peer-reviewed review articles (R) (see Table 1), (ii) peer-reviewed empirical studies (E) (see Table 2), and (iii) non-peer-reviewed articles (N) (see Table 3).

The majority of articles (30 articles) were empirical studies, including studies that measured acquisition of knowledge, development of skills, as well as measurement of attitudes and opinions of learners or instructors. There were 13 review articles included in this scoping study. These articles generally consisted of reviews of current literature on various topics related to eLearning in the global south. There were two non-peer-reviewed articles included in the scoping study, one from the World Health Organization (WHO) and one article from the World Summit on the Information Society, published in the UN chronicle. These two articles outline various key features of eLearning implementation in the global south from an international organization perspective.

3.1.2. Characteristics of Populations Depicted in Articles

Of the 45 of relevant articles in this scoping review, Brazil (R0, E3, N0), Tanzania (R1, E2, N0), and Thailand (R0, E3, N0) shared the largest geographic representation (three articles each). Eight studies (R5, E1, N2) looked at eLearning implementation in the global south in general, without naming specific countries and four studies (R3, E1, N0) looked at eLearning worldwide, but included results and discussion sections that specifically addressed eLearning in the global south. In terms of the types of learners depicted in the articles, most were professionals, with representation from a range of disciplines. Of the 45 articles in this scoping review, 33 articles (R6, E26, N1) focused on health-related applications of eLearning and 14 articles (R8, E5, N1) focused on learners from non-health related professions, such as education, engineering and law. It is important to note that the majority of learners depicted in the articles were professionals, generally with higher-than-average education and computer experience. Non-professionals or learners with disabilities were not discussed as learners in the articles. Tables 1–3 provides further information about countries and professions represented in the articles.

3.1.3. Method of Delivery of eLearning

The most common method of delivering eLearning to resource-constrained areas was via the Internet, with 43 articles discussing implementation of eLearning using the World Wide Web. Five articles discussed the potential use of mLearning, or mobile learning, as a platform for delivering content in the global south. For example, Chang and colleagues, explored mLearning by providing a 3G smartphone with pre-equipped information-based applications, which were utilized by medical residents in Botswana [50]. It is important to note that calling and texting features were disabled from these devices so the phone was used solely for eLearning purposes. Four articles discussed video-conferencing as the key method for training the targeted population. Other methods used included blended learning (11 articles), which employed a combination of traditional learning and

eLearning, and offline learning (6), which used electronic materials such as CD-ROMs or USB sticks. Table 1 provides further information about specific methods addressed in each article.

3.2. Benefits of eLearning

There are many benefits to using eLearning in the global south that were highlighted in the articles. Here, we report benefits particularly related to access, interest/outcomes, and sustainability. As it relates to access, 26 articles (R8, E16, N2) in the scoping review indicate that eLearning extends access to education into geographic areas and among populations that may not otherwise have access to such training via more traditional, classroom-based methods. For example, Frehywot and colleagues note that eLearning is the most efficient and cost effective strategy for educating a large number of individuals over a wide geographic area [26]. Furthermore, Aczel notes that eLearning extends the reach of experts in order to build capacity in remote areas of the global south [18]. eLearning can also increase access to education in areas that may face challenges in Internet and Communication Technology infrastructure. For example, Rasmussen and her colleagues found that certain methods of eLearning, such as via CD-ROM or USB stick were particularly useful in these contexts [28].

Another key benefit of eLearning in the global south relates to both student and faculty enjoyment and outcomes, with many articles reporting positive attitudes toward eLearning. For example, more than half of the studies discussed the attitudes of the students and instructors in terms of implementation and use of eLearning. Articles that involved empirical data measuring student satisfaction and/or outcomes mainly reported that students were satisfied with the use of eLearning, preferred interactive online learning compared to reading a textbook, and enjoyed the overall experience. For example, De Maio conducted a study implementing a traditional medical training course as an Internet-based course for students in Brazil and found that 89% of students enjoyed the experience and 88% of students reported they would enrol in another course via the Internet [30]. In a different study that examined delivery of a web-based curriculum of bronchoscopy material, 75% of learners reported the contents of the training were easier to remember using the computer-based interactive question-answer style compared to the same information presented in a textbook, with 66% of all participants noting that learning using the web-based curriculum was "less boring" than reading a textbook [35]. Another study demonstrated that instructors consider eLearning to be a valuable instrument to develop education to meet the need for a qualified, educated workforce [34]. In addition to positive reception from learners and instructors, the majority of articles (42) (R13, E27, N2) demonstrated that eLearning offered similar or better knowledge outcomes than traditional learning. For example, several studies demonstrated that knowledge acquisition and skill building in eLearning is equivalent to, or better than traditional learning. Moreover, Rasmussen and colleagues conducted a systematic review comparing offline eLearning to traditional learning and found several studies that demonstrated significantly higher knowledge gains in eLearning, as compared to traditional learning [28].

Finally, articles discussed the benefits of eLearning as it relates to sustainability, with 11 articles (R4, E6, N1) mentioning sustainability of eLearning programs in some form. All 11 articles measured sustainability of eLearning on a short-term basis (less than one year). Five of these articles (R2, E3, N0) reported sustainability in a primarily organizational sense, for example, securing long-term incorporations of government plans [19] as well as consistent government, donor, and dealer

implementation of eLearning initiatives [52]. Three articles (R2, E1, N0) discussed sustainability in a financial sense such as, adopting technology to maintain teaching quality at reduced unit costs [27]. Hogan discusses the financial sustainability of eLearning as it, "opens the door to accessible and affordable education and that it can be a basis of economic survival for emerging nations" [47]. Another two articles (R0, E1, N1) discussed cultural sustainability in eLearning. Some studies have indicated the potential of financial and organizational sustainability of eLearning programs, while others have admitted that sustainability is still a challenge. For instance, O'Brien and Hardman indicate that eLearning participants of their hand-therapy program expressed a concern for the sustainability of the program after the trainers left since there was no continuing education and professional development [57].

3.3. Challenges

Although the articles included discussion of many benefits of eLearning, such as improved access, student and instructor interest/outcomes, and increased sustainability, articles also highlighted key challenges of using eLearning in the global south. Three key challenges of eLearning were apparent from the scoping review: limited technical infrastructure, cultural disparities, and challenges navigating the technology. The most consistently-cited challenge (nine articles) (R3, E6, N0) was related to implementing eLearning in resource-limited areas that have little to no technological infrastructure. For example, Gulati acknowledged that, although traditional technologies remain more effective and accessible for rural and disadvantaged groups, traditional methods still fail to provide adequate educational opportunities [21]. Gulati also notes that in spite of challenges, developing countries should continue to develop IT infrastructures in rural and deprived areas, as this is often a key catalyst for increased development and opportunity [21].

Cultural disparities, including language barriers, cultural differences, knowledge differences, and difficulty understanding texts were revealed in 11 articles (R3, E7, N1). For example, an article in the UN Chronicle states that "the lack of content in native languages is a serious impediment to Internet use in many countries", which would hinder the using eLearning programs [59]. This is further supported by the finding that both instructors and participants seemed to have difficulty navigating the eLearning software and would have preferred the option to express themselves in their native language [43,46].

Challenges navigating the technology were discussed in three articles (R0, E3, N0). These articles noted attitudes on eLearning and reported that students were unfamiliar with the technology and, therefore, eLearning was not appropriate due to the time constraints of the study, and they did not consider eLearning a better option than traditional learning [31,33,42].

3.4. Suggestions for the Future

Many of the articles reviewed (12 articles) (R7, E5, N0) revealed several strategies for future implementations of eLearning programs. Some of the strategies involved developing quality and credible programs [16,36,45], while others suggest encouraging contact between students and students and faculty [23,43,45]. In addition, a common recommendation for eLearning initiatives was to develop a partnership between the global north and the global south. The authors suggest that this

partnership could not only provide financial support, but provide successful eLearning models from which to build upon [18,26,28,36,44]. Table 4 further summarizes key recommendations from these 12 articles.

Table 4. Key recommendations found throughout the scoping review.

References	Recommendations
Aczel, Peake, and Hardy, 2007 [18]	Collaborations with global north
Andersson and Gronlund, 2009 [23]	Faculty support for students, social support for students, minimum baseline computer skills,
Bhuasiri, Xaymoungkhoun, Zo, Rho, and Ciganek, 2011 [45]	Interaction between students and with instructors, provide equipment training, allow for course flexibility, invest in quality systems, well-designed curriculum and learning materials
Dhanarajan, 2001 [16]	Equitable access to services, remove barriers to learning, well-designed curriculum and learning materials, standardized assessment, proof of participation (certification), staff training, sensitivity to students
Frehywot, *et al.*, 2013 [26]	Collaborations with global north
Geissbuhler, Bagayoko, and Ly, 2007 [19]	Improve existing technological infrastructure, involve instructors, working professionals and technical coordinators in implementation
George, *et al.*, 2014 [55]	Blended learning
Gulati, 2008 [21]	Allow for course flexibility, understand target population, holistic policies
Johnson, Ghebreyohanes, Cunningham, Kutenplon, and Bouey, 2007 [36]	Collaborations with global north, well-designed curriculum and learning materials, staff training, clinical education focus, allow for course flexibility
Nartker, *et al.*, 2010 [43]	Blended learning, encourage study groups, staff training, social support for students
Rasmussen, *et al.*, 2014 [28]	Collaborations with global north
Vyas, Albright, Walker, Zachariah, and Lee, 2010 [44]	Collaborations with global north

4. Discussion

This scoping review explored the question "What is known from the existing literature for effectiveness and sustainability of eLearning for capacity building for community based rehabilitation?" The initial search terms did not uncover eLearning articles directly linked to CBR—potentially indicating that either eLearning is not widely integrated in CBR practice, or that if it is being implemented, it is not being discussed in scholarly venues. A revision of search criteria to eliminate CBR as a required term returned 45 articles and grey literature from fields not explicitly connected to CBR. Key themes related to eLearning in the global south were (a) description of characteristics, (b) benefits, (c) challenges, and (d) suggestions for the future. Many organizations, including WHO and a number of other professional and non-profit organizations, are increasingly turning to information and communication technology (ICT) as a platform for developing online continuing education and training programs for individuals in the global south [60]. As WHO has been using eLearning strategies for several of their programs, eLearning initiatives may be particularly beneficial to the

WHO-supported strategy of CBR for community development. Although we were not able to find eLearning specifically linked to CBR practice, we nevertheless believe that the results from articles related to eLearning in fields connected to CBR (e.g., health, social service) in the global south might inform the future application of eLearning for CBR capacity building. Specifically, from this review, we propose that eLearning might be highly sustainable to use in CBR because it is can be a useful tool for increasing accessibility for people with disabilities, ensuring learning that is easily accessible to a rural, or geographically disparate, population using creative or multiple methods of delivery, and increasing sustainability through decreased cost or human resource requirements.

The results from the scoping review uncovered a wide range of disciplines in many different countries that utilized eLearning. These points allude to the generalizability of eLearning and therefore the potential applicability of eLearning to CBR programming for individuals with disabilities and their families, along with professionals, in a wide range of contexts and cultures. Some of the articles discussed the ability of eLearning to reach a diverse population. One of the exclusive features of eLearning is the ability to access the information from any device with web connectivity. For individuals who may be typically excluded from accessing traditional trainings (due to inaccessible training venues, methods, or public transportation systems, *etc*.) eLearning may provide people with disabilities increased opportunities to engage in capacity development in a location and/or at a time that best meets their personal learning and accessibility needs.

Although eLearning may be an important solution for building knowledge in individuals with disabilities, there may be a void in terms of base knowledge or computer skills that must be considered for future CBR implementations. For example, many people with disabilities are denied educational opportunities and thus may not have the necessary education or computer knowledge to access eLearning—an issue demonstrated by the fact that the majority of learners in the articles we found were educated professionals. The need to build in computer skills training may be included as an essential element of future eLearning in CBR. Additionally, a key lesson highlighted in over 25% of the studies included in this review was the recommendation to implement blended learning in future eLearning projects in resource-constrained areas. Blended learning incorporates traditional learning with an eLearning component. In other words, to supplement the eLearning curriculum, there is hybrid of electronic and face-to-face instruction, or hands-on part of the program. This was a common recommendation where trainings involved acquiring practical skills, such as in medicine [60]. Consideration of blended learning formats for eLearning initiatives may be particularly relevant for professional continuing education in CBR, where development of hands-on skills are often an important component of learning in many components of rehabilitation.

In addition to suggesting the relevance of eLearning for populations generally involved in CBR capacity development, our scoping review uncovered several articles that suggest that eLearning may increase access to education, particularly in areas where educational opportunities are scarce. As CBR's fundamental aim is to locate services as close as possible within local communities, eLearning is highly appropriate and applicable to the goals of CBR to bring services and opportunities into communities, rather than requiring travel to urban areas for access.

This scoping review suggested that when compared with traditional forms of learning, accessing eLearning services did not compromise education gains, but rather outcomes were equivalent, if not better, than traditional learning for knowledge acquisition and skill building [28]. This indicates that

eLearning could still provide education in a way that meets high international standards and remains meaningful and helpful to beneficiaries.

Finally, in addition to being appropriate to populations generally targeted for CBR, relevant for bringing services back into local communities and meeting student outcomes, development of eLearning components in CBR may be one strategy for addressing critiques of sustainability in CBR programming. As made evident through the scoping review, sustainability involves many different facets: organizational sustainability, financial sustainability, and cultural sustainability. These different forms of sustainability were all identified in the articles—indicating eLearning's relevance to numerous aspects of sustainability. The articles reviewed noted that eLearning programs have the advantage of mitigating overall costs of education in the long run and of disseminating knowledge across a wide population.

As it relates to financial sustainability, although CBR may have extensive initial costs, partnerships and collaboration between developed countries and developing countries can help offset these costs and provide other mutual benefits, as highlighted by the Millennium Development Goals [61]. Throughout the scoping review, collaborations have been shown to help provide successful guidance, share costs associated with implementing eLearning infrastructure, as well as enrich international relations. Further, after the initial investment in program development and content creation, many eLearning platforms may require much fewer human resources for teaching and course updates, and related activities, and thus eLearning may be more easily sustained with new learners even after funding for a CBR project finishes.

Although eLearning may be a more financially sustainable option in some cases, eLearning may have other challenges related to sustainability, as highlighted in the articles. For example, the inability to institute modern technology in resource-constrained areas continues to be the main challenge when implementing eLearning and, thus, certain types of eLearning may be more conducive to some contexts or areas than others. One recurring solution for delivering eLearning in rural areas with extremely limited infrastructure that emerged from the articles was the use of mobile learning or mLearning. Delivering eLearning through mobile devices may be particularly applicable and relevant to future CBR practice, as mobile devices and wireless networks might enable the most resource-constrained areas to implement ICTs by evading low-bandwidth and substandard computer resources [50]. As smartphones become more affordable worldwide, mLearning may play an integral role in providing education to people in remote and resource-limited areas of the world, an opportunity foreseeable for CBR. mLearning initiatives may allow for more people to participate, as more people may be able to afford mobile phones compared to a computer. Furthermore, according to the Global Mobile Health Report, by 2015, an estimated 500 million people will access mHealth applications on smartphones [62]. Future CBR managers may consider integration of mLearning platforms as a way to mitigate implementation challenges related to limited access to ICT resources.

In addition to mLearning as an option for bringing eLearning to rural areas that have difficulties in implementing modern technological infrastructure was offline learning. In our scoping review, several studies discussed the use of offline material delivered through CD-ROM and USB sticks. Current evidence suggests that over 60% of the worldwide population is not connected to the Internet, most of whom reside in rural areas of developing countries [63]. As such, offline learning may be an important

and viable option for ensuring that eLearning in CBR programming reaches communities with limited Internet connectivity.

This review has demonstrated how eLearning holds great promise for strengthening education and skills development within CBR. Yet, future research should explore how to overcome the various challenges that remain with eLearning in disability and CBR. Such challenges might include how to integrate universal design standards and principles in educational material delivered through internet and communication technology; how to adjust training material to the specific needs of disabled people; how to ensure greater technological, financial, and information accessibility; and how to include specific populations such as children with intellectual disabilities and older people in eLearning.

5. Limitations

Although this scoping review suggests that eLearning could be a useful and viable method for capacity development within CBR programming, our study is not without its limitations. Firstly, the exclusion of articles that did not explicitly link with the "global south" may have excluded articles that could have provided more information on the effectiveness and the sustainability of eLearning that are not impacted by contextual or geographical factors. Secondly, this scoping review grouped many diverse countries under the term "global south", eliminating the subtleties of cultural contexts. Consequently, if researched individually, eLearning in different continents or regions may illustrate different circumstances important to consider in context-specific CBR practice. Thirdly, the search uncovered zero articles linking eLearning and CBR. This likely indicates a gap between research and practice, as casual conversations with organizations implementing CBR leads us to believe that many organizations have already implemented eLearning programs in CBR but these have simply not been captured in academic literature. Expanding the research to include evaluations of eLearning programming among humanitarian organizations was beyond the scope of this review. As such, we are not purporting that eLearning is currently absent from existing CBR programs, but simply that our search of academic literature did not uncover relevant articles on the topic. In spite of these limitations, we believe that this scoping review provides relevant information related to future application of eLearning in CBR.

6. Conclusions

This scoping review explored existing literature related to eLearning in the global south and discussed the applicability of using eLearning in CBR. Given that a major component of CBR is to build capacity of local populations to better ensure inclusion of people with disabilities, it is important for CBR practitioners to integrate eLearning as a potential tool to ensuring greater relevance, utility, and sustainability of capacity building programming—not just for educated professionals (the population most often reached by eLearning in the global south), but also for people who may simply need greater support achieving minimal education and computer skills requirements before commencing the official training. Further research might focus on finding and evaluating existing eLearning in CBR, determining the sustainability of eLearning programs in the global south, improving access to technological infrastructure for eLearning platforms in the global south, and

increasing collaboration between developed countries and developing countries for development of eLearning programs.

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Author Contributions

Study design (Karly Michelle Dagys, Amaal Popat and Heather Michelle Aldersey); collected, analyzed, and interpreted the data (Karly Michelle Dagys, Amaal Popat); drafted or critically revised the manuscript (Karly Michelle Dagys, Amaal Popat, Heather Michelle Aldersey); All authors have read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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