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ORIGINAL RESEARCH



# Integration of wheelchair service provision education: current situation, facilitators and barriers for academic rehabilitation programs worldwide

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## ABSTRACT

**Purpose:** An estimated 75 million people with disabilities need wheelchairs globally, of whom 5–15% have one. Access to an appropriate wheelchair requires rehabilitation professionals trained to provide wheelchair service. One aim of the International Society of Wheelchair Professionals (ISWP) is to promote and facilitate the integration of wheelchair service provision education into academic rehabilitation programs worldwide. To inform the development of integration strategies, the purpose of this study was to develop an in-depth global portrait of the wheelchair service provision education offered in academic rehabilitation programs, the process of its integration and the associated facilitators and barriers.

**Method:** Semi-structured qualitative interviews were conducted with a purposive sample of 14 representatives from academic rehabilitation programs (i.e., occupational therapy, physical therapy, and prosthetics and orthotics) in 11 countries, including low, middle and upper resourced settings.

**Findings:** Thematic data analyses identified three overarching themes. The first theme, “impact of context”, portrays factors related to local population needs, governance and supply chain of equipment and service delivery. The second theme, “current and planned wheelchair education”, describes the content, pedagogic approach, student evaluation and feedback process. The third theme, “integration process”, details five states of this process.

**Conclusions:** This study describes in-depth the wheelchair service provision education across academic rehabilitation programs and resource settings, illustrating the context-dependent nature of its integration. This understanding may assist the global community of educators in preparing future rehabilitation professionals to better serve wheelchair users. This work has informed the development of ISWP’s Seating and Mobility Academic Resource Toolkit (<http://smart.wheelchairnetwork.org/>).

## ARTICLE HISTORY

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## KEYWORDS

Wheelchair; education; service provision; worldwide; rehabilitation programs

## ► IMPLICATIONS FOR REHABILITATION

- The *Dynamics of Context-Dependent Integration of Wheelchair Service Provision Education in Curricula* model, depicting the findings of this study, may help to inform key stakeholders (i.e., academic institutions, health care providers and policy makers) about potential barriers and facilitators to the implementation of adequate wheelchair service provision education in the curricula of academic rehabilitation program.
- Study findings may lead to creative strategies, such as the expansion of ISWP’s Seating and Mobility Academic Resource Toolkit (SMART; <http://smart.wheelchairnetwork.org/>), that may enable academic rehabilitation programs to be a part of the solution to strengthening rehabilitation systems worldwide, through appropriately trained rehabilitation professionals in wheelchair service provision.

## Introduction

There are approximately 75 million people in the world who need a wheelchair for mobility [1]. Only 5–15% of this population have access to one, which may or may not be appropriate for the individual’s needs [1]. To ensure all wheelchair users receive appropriate wheelchair service, the “Guidelines on the Provision of Manual Wheelchairs in Less Resourced Settings” were developed and it included a consensus-based service delivery model [2] that has since demonstrated beneficial outcomes for wheelchair users [3–5]. Despite the effectiveness of this wheelchair service delivery

model, its implementation is often challenged by a lack of trained wheelchair service providers [6]. Therefore, to establish optimal assistive technology systems for the provision of appropriate, affordable and effective assistive technology, including mobility devices such as wheelchairs, there is a fundamental need to educate and to train relevant personnel [7–10].

Educating rehabilitation professionals, including occupational therapists, physical therapists, orthotists and prosthetists in academic rehabilitation programs, such as training programs in Occupational and Physical Therapy, is one means of increasing

the number of trained relevant personnel. Currently, however, the amount of wheelchair service provision education provided is far less than recommended. For instance, findings of a recent global survey conducted by ISWP of 72 educational institutions in 21 countries indicated that 21% of rehabilitation university programs do not teach any wheelchair content [11]. For those institutions included wheelchair services education in their curricula, there was great variability in terms of the content taught, the pedagogic approach used and the evaluation of students' learning. There was also a wide range in the number of curriculum hours dedicated to wheelchair education (i.e., 2–45 h). Importantly, only 25% of institutions used evidence-based open-source content, such as the WHO Wheelchair Service Training Packages [12–14], the Wheelchair Skills Program [15] and the Wheelchair Maintenance Training Program [16] and only 46% of the sample was aware of the WHO training packages. It is reasonable to infer that the survey findings indicate the need to enhance the awareness of existing resources and the inclusion of evidence-based wheelchair education content offered in academic rehabilitation programs, in order to improve the clinical implementation of the recommended 8-step wheelchair service provision process.

During the addition to or enhancement of any content into curricula, there may be a variety of challenges, and wheelchair content is no exception. Lack of educational standards [7,17], lack of qualified instructors or expertise among faculty, lack of academic preparation of students, perception of content appropriateness for entry-level program [18], lack of knowledge regarding how to embed content into existing curricula and fluctuating levels of commitment and resources [19] are examples of barriers faced in integrating education in the areas of genetics in occupational therapy curricula, joint manipulation in physical therapy curricula and cultural competency in a graduate rehabilitation program respectively. These studies highlighted the variety of barriers to integration of new content into rehabilitation university curricula. With the growing body of knowledge on wheelchair education, the global awareness of the need for trained personnel in wheelchair service provision and the availability of open-source wheelchair education material, little is known on why the integration of wheelchair service provision education into academic rehabilitation programs is not happening at a significant pace. Barriers specific to the integration process of wheelchair service provision education into academic rehabilitation programs have not yet been studied.

Thus, the aim of this study was to develop a more in-depth global portrait of the wheelchair service provision education offered in rehabilitation university programs, the process of its integration into program curricula and the associated facilitators and barriers. This knowledge may help to address the lack of trained wheelchair service providers through enhanced wheelchair service provision education in academic rehabilitation university programs worldwide.

## Methods

### Design

A generic qualitative methodology approach [20] was used to conduct semi-structured qualitative interviews. The study was approved by the Institutional Review Board of the University of Pittsburgh (PRO16070410).

### Sample and recruitment procedure

A volunteer sample of representatives from 14 universities was purposively recruited through the ISWP member database using

an e-mail invitation. ISWP currently has over 3000 members from 108 countries, many of whom are educators in rehabilitation programs. Representatives were eligible to participate if they (1) were a faculty member in an occupational therapy (OT), a physical therapy (PT), or a prosthetics and orthotics (P&O) academic program; (2) were currently teaching wheelchair content or were in the process of planning to teach wheelchair content in one of the specified health care disciplines; and (3) were able to read and speak in English, Spanish or French (the native languages of the interviewers). The goal was to obtain a balanced sample with respect to health care discipline and resource level (i.e., low-, middle- and high- resourced settings) [21]. All individuals contacted, with the exception of three, agreed to participate. All participants provided informed consent prior to participation in the study.

### Data collection

Each participant took part in one interview (a duration of  $56.4 \pm 20.4$  min) that was conducted using a semi-structured interview guide. The guide, developed by the ISWP, was designed to explore participants' experiences with the integration of wheelchair service provision content into their respective program. It began by providing a description of the ISWP, the goal of the project and a definition of integration of wheelchair service provision content (i.e., the addition or the enhancement of wheelchair education). The interviewer also described the definition of the WHO 8-step wheelchair service provision process, which includes (1) referral, (2) assessment, (3) prescription, (4) product preparation, (5) funding, (6) fitting, (7) user training and (8) follow up and maintenance [2]. The guide included 13 questions querying details regarding the rehabilitation program itself (e.g., profession, length of program, resource setting), the current wheelchair service provision content taught and the process of integrating wheelchair service provision content into the program. Each question was open-ended and had a variety of possible probes. Sample questions include "Could you describe the wheelchair content taught in your program/that you would like to see taught in your program?", "Could you comment on how the wheelchair content provided relates to your students' scope of practice?", "Could you describe any facilitators/barriers that you've experienced related to the integration of wheelchair content into your program?" and "What has helped/could help you to overcome the barriers to integration of wheelchair content into the curriculum?". Data regarding the demographics of each participant (e.g., age, sex and position at the university) were also collected.

The interviews were conducted by five members of ISWP and authors of this article (MG [ $n=1$ ], KF [ $n=6$ ], MLT [ $n=2$ ], NS [ $n=3$ ] and TM [ $n=2$ ]) between August 2016 and August 2017 in the primary language of the interviewer (i.e., English or Spanish as preferred by the interviewee). All interviews were held in person, by the Internet on Skype (Skype Technologies, Palo Alto, CA) or by Adobe Connect, a web conference platform (Adobe, San Jose, CA). The interviews were audio recorded (using either an audio recorder, Skype or Adobe Connect functions) and transcribed verbatim in the language of the interview. The interviews conducted in Spanish were translated into English by a team member fluent in both Spanish and English (MLT).

### Data analysis

Generic qualitative thematic analysis was conducted using an inductive approach [20]. Upon completion of the interviews, two team members (K. F. and T. M.) independently coded and

categorized the data. To ensure reliability and prevent bias, codes and categories were crosschecked and reviewed by three additional authors (M. G., P. W. R. and N. S.) until consensus was reached. The next step involved collaborative development of themes by these five team members, based on the codes and categories. The data were organized and analyzed using NVivo for Mac (Version 11.4.1, QSR International Pty Ltd, Victoria, Australia).

The study procedures incorporated a number of trustworthiness strategies [22]. Dependability and credibility of our study design, data collection and analyses were enhanced through the diverse backgrounds of the study investigators. Specifically, our team of wheelchair experts included one OT practicing in a LRSs (N. S.), one OT with a PhD in Rehabilitation Sciences (P. W. R.), one OT student at a university in a HRS (K. F.), one P&O and PhD student at a university in a HRS (T. M.), one biomedical engineer with a PhD in Rehabilitation Sciences (M. L. T.), one educator with a PhD in Administrative and Policy Studies of Education (M. G.) and one mechanical engineer with a PhD in Rehabilitation Science (J. P.). Additionally, PWR, MLT, MG and JP are faculty members at universities in MRS or HRS. Triangulation and confirmability were established through post-interview debriefing that occurred in the monthly ISWP meetings by 4–5 authors, plus other members present. These debriefings involved reflective commentaries that facilitated refinement of the interview guide, discussion of initial impressions of the data and identification of areas requiring further investigation. The preparation of the manuscript was guided by the Consolidated Criteria for Reporting Qualitative Research (COREQ) 32-Items Checklist [23].

## Findings

The 14 study respondents and their respective academic programs are described in Table 1. Three overarching themes were derived from the data. The first theme, *Impact of Context*, with the sub-themes local population needs, governance and supply chain of equipment and service delivery highlighted impact of contextual factors on the integration of wheelchair service provision education in the curricula. The second theme, *Current and Planned Wheelchair Education*, with the sub-themes content,

pedagogic approach and student evaluation and feedback process described wheelchair service provision education that was planned and/or already integrated into their curricula, even if it was minimal. The third theme, *Integration Process*, identified five states of the integration process, including advocacy, planning, course development and delivery, first-time implementation and improvement (Table 3).

Table 2 summarizes the barriers and strategies participants recommended to overcome the barriers that have been integrated into the main themes. Extrapolated from the three main themes, Figure 1 depicts the dynamic context-dependent relationship among the factors that influence the integration of wheelchair service provision education into the curricula.

### *Impact of context – “the picture is quite different depending on where you live...”*

#### *Local population need – “needs of the community”*

All participants reported consideration of social and clinical needs in the local context during the integration process of wheelchair service provision curricula. For example, participants from LRSs supported the integration of wheelchair education when the local population needs were inadequately met in the clinical setting. This perspective was described by Participant 12 (OT, LRS) “We will have to look at the curricula... how much [wheelchair service provision content] is being taught at the moment, how relevant [it is] in the current situation... adapt ... to meet the needs of the population that is living at the moment... What they [government] want to see are new programs coming up that meet the needs of the community”. The participants hoped that wheelchair service provision education would eventually help to fill the gap in wheelchair service as expressed by Participant 7 (P&O, LRS), “By the end of these 5 days [length of training], we are happy if the [students have] ... taken on board what we taught them. We aim ... that wheelchair service provision [in Sudan] is also going to be opened up a bit, because as such, it does not exist”. In contrast, participants from HRSs perceived that the goal of integrating wheelchair education was to provide sufficient knowledge and practical skills to match the current scope of practice. For

Table 1. Characteristics of participants and their respective programs (n = 14).

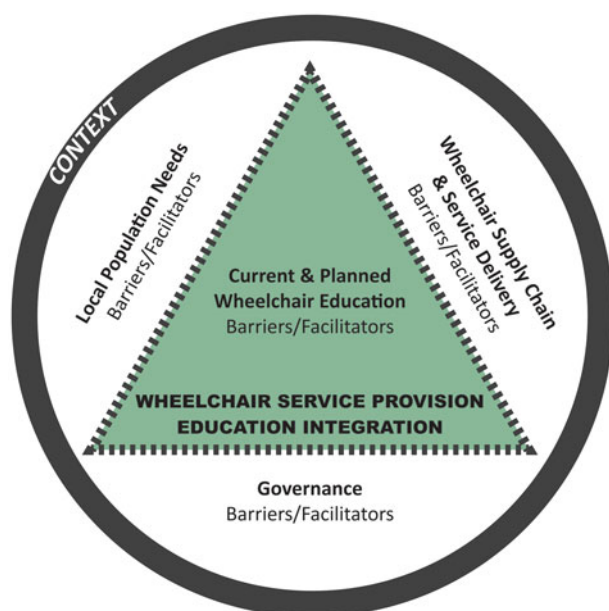
Participant number	Respondent's university position (sex)	Program type	Education level	Number of students per cohort	Length of program	Timing of wheelchair education within curriculum	Country	Level of resource setting
1	Adjunct professor (F)	OT	Bachelor-Master's Continuum	130	4.5 year	Bachelor: second year, Master's: optional	Canada	High
2	Instructor (M)	PT	Bachelor	20	3 year	Second year	Togo	Low
3	Undergraduate Program Head (F)	P&O	Bachelor	16		Third year		
		PT	Bachelor	15–20	5 year	Third or fourth year	Colombia	Middle
4	Professor (F)	FT	Bachelor	50–60	3 year	Second year	Honduras	Middle
5	Professor (M)	OT	Master's	50	2 year	First and second year	Canada	High
6	Professor (F)	PT	Doctorate	40	3 year	First, second and third year	United States	High
7	Training Coordinator (M)	P&O	Bachelor	15	3 year	First year	Sudan	Low
8	Associate Professor (F)	OT	Doctorate	34	3 year	First and second year	United States	High
9	Senior Lecturer (F)	OT	Master's	2 year				
10	Assistant Professor (F)	OT	Bachelor	30–40	3 year	First and second year	Romania	Middle
11	OT Department Head (F)	OT	Master's	30	4 year	Third year	Philippines	Middle
		OT	Bachelor	80	3 year	Mainly in First year, also second and third year	United Kingdom	High
12	OT Department Head (M)	OT	Master's	2 year				
13	Research Scientist/Faculty Member (M)	P&O	Diploma	50–60	3 year	Second year	Kenya	Middle
		P&O	Master's	15	2 year	Second year	United States	High
14	Consultant-Lecturer (F)	P&O	Bachelor	20–30	4 year	Fourth year	Thailand	Middle

FT: functional therapy; OT: occupational therapy; P&O: prosthetics & orthotics; PT: physiotherapy; F: female; M: male.

**Table 2.** Perceived barriers and strategies in the integration of wheelchair service provision content into curricula.

Principal Barriers	Associated Barriers	Strategies to overcome barriers
Time Constraints		<ul style="list-style-type: none"> <li>• Flexibility in Time</li> <li>• Advocacy for wheelchair service provision education*</li> <li>• Independence for curriculum change</li> <li>• Online learning material*</li> <li>• Collaborations: nonprofit organizations</li> <li>• Collaborations: local rehabilitation clinics</li> <li>• Guest Lecturers</li> <li>• Consultants</li> <li>• Readily available training packages*</li> <li>• Access to local wheelchair clinic</li> <li>• Collaborations: local rehabilitation clinics</li> <li>• Wheelchair Suppliers</li> <li>• Donations from NGO</li> <li>• Loans/Donations from wheelchair suppliers</li> <li>• University Funding</li> <li>• Readily available training packages*</li> <li>• Awareness of wheelchair service provision*</li> <li>• Student interest</li> <li>• Positive course evaluations</li> <li>• Supportive administration</li> <li>• University Resources</li> <li>• Recommendations from WHO, ICRC, professional governing bodies*</li> </ul>
Limited Human Resources from the academic institution to teach wheelchair education	<ul style="list-style-type: none"> <li>• Limited Funding</li> <li>• Limited Expertise</li> </ul>	
Limited physical resources	<ul style="list-style-type: none"> <li>• Lack of training for instructors</li> <li>• Physical space limitations</li> <li>• Limited wheelchairs and related equipment</li> <li>• Limited Funding</li> </ul>	
Difficult integration process	<ul style="list-style-type: none"> <li>• Lack of teaching material</li> <li>• Limited faculty interest, resistance, limited awareness</li> </ul>	

\*Resources available in ISWP's Seating and Mobility Academic Resource Toolkit (<http://smart.wheelchairnetwork.org/>).

**Figure 1.** The dynamics of context-dependent integration of wheelchair service provision education in curricula.

instance, Participant 11 (OT, HRS) described that in her context wheelchair service was considered a specialty practice and thus, "An emphasis on awareness and basic assessment [...] would be a minimum of what we would expect them [the students] to do. [...] It wouldn't be deemed a priority because they may not end up in a wheelchair service".

#### **Governance – "respect the law and the regulations ..."**

Another contextual factor that was described as influencing the integration of wheelchair service provision education was governance on a geopolitical level, as well as on the academic level. In one instance, Participant 10 (OT, MRS) explained, "In the Philippines, most OT schools are regulated which means that if you want to change the content or include some [new] content, you would have to target the commission on higher education, the technical committee". Similarly, Participant 12 (OT, MRS)

described that policies or guidelines originating from geopolitical governance might encourage the integration of wheelchair service provision education and the importance of collaborating with the government, as reflected in the following statement, "It is very critical that [our academic institution] with that medical [and clinical] knowledge participate in the disability mainstreaming". In contrast, Participant #7 (P&O, LRS) described challenges when policies and guidelines were unclear or lacking in saying, "Wheelchair service provision has been getting much more important. Sadly, there isn't one policy that covers all the ... rehabilitation policy or anything of that sort ... I hate the risk of getting people trained and they cannot practice when there are users needing the service". However, policies and guidelines, whether from geopolitical or academic governance, were not always considered a prerequisite to integration. Several participants, notably from HRSs, expressed that they were able to work within stated regulation or policy to integrate wheelchair-specific content within the existing curricula. For example, Participant 1 (OT, HRS) stated, "I think as long as I can justify why I am doing what I am doing and I stay within the hours that are allocated for the course ... 'it is fine". Overall, while participants from LRS elaborated more on the impact of geopolitical governance, the participants from HRS spoke more about rehabilitation professional regulatory bodies, whether on a national or an international level. Interestingly, many participants described existing education standards to be sufficiently general to justify the integration of wheelchair service provision education.

#### **Supply chain of equipment and service delivery – "this is what is available to us"**

Participants reported that wheelchair service delivery was largely dependent on the ability to access the equipment within their country and emphasized the need to ensure that students in rehabilitation professional programs are trained to provide the most appropriate wheelchair service provision process within the existing resources in their context setting. Participant #10 (OT, MRS) explained the interconnectivity of service delivery and the supply chain in describing, "We can train a lot of OTs or PTs to do [wheelchair] service provision, but ... if there is no industry available to supply appropriate chairs – it is just one part of the



picture". Participants also perceived that the integration of wheelchair service provision education into curricula required access to equipment available through the local supply chain. This aspect of education was often facilitated by donations and loans from local suppliers, as reported by Participant 1 (OT, HRS), "I didn't think I was going to be quite as fortunate as I was to getting chair donations and chair loans... From that perspective; it [development of a new wheelchair course] was a pretty well supported endeavour". In contexts where the supply chain was not present, the integration of wheelchair content was harder to justify. For instance, Participant #12 (OT, MRS) discussed the futility of teaching wheelchair maintenance and follow up because, "It is that once they are broken down we have nowhere to render them for their spare parts... it will bring about... issues of the difficulty of maintaining the service..." Generally, all participants stated that the wheelchairs used to provide education came from a mix of non-governmental organizations (NGOs), local clinics and private manufacturers.

### ***Current and planned wheelchair education – "the WHO packages.... as a benchmark"***

#### ***Wheelchair education content – "improvement to the students' knowledge and skills"***

All participants from LRSs planned to base their entire wheelchair service provision education on the WHO materials [2,12,13]. For example, Participant 7 (P&O, LRS) stated, "The WHO package itself [...] is something we are looking at. I don't know if you want to put it as a benchmark, but we will look at it that way. [...] I mention the WHO; it has the respect and precedes itself". In contrast, while creating their own teaching material, several participants in HRS and one in MRS used the WHO WSTP mainly to supplement the more context-specific content, as described by Participant 3 (PT, MRS), "[The WHO WSTP] will be really useful, but [...] we have to have in mind that if we are going to guide ourselves with this model, [we still need] to structure [our wheelchair course] based on the needs of our population and country." and Participant 5 (OT, HRS), "We are going to set [the WHO WSTP material] in parallel. [...] They won't be the core material, but they will be [supplementary material](#) that the students have access to and [...] encouraged to look at".

Other wheelchair service training resources mentioned by the participants included the Motivation packages from Motivation Charitable Trust, United Kingdom, the WHO Community-Based Rehabilitation Learning Community [24], the Wheelchair Skills Program (WSP) [15] and the Pittsburgh Maintenance Package [16]. As demonstrated by the following quote from Participant 6 (PT, HRS), the participants alluded that the use of evidence-based, open-source materials depended on their awareness of the material's existence, "Probably if I had been more aware at the beginning, I might have developed the material around the WHO".

Despite initially stating that their programs cover the basic level of wheelchair provision (i.e., all eight steps of the WHO recommended wheelchair service provision process), most participants described content in only three of the steps: assessment, prescription, and user training. A few participants from HRSs, who both taught and conducted rehabilitation research, included theoretical and/or practical wheelchair service provision content relating to their research interests: assessment and user training in the area of wheelchair skill and wheelchair confidence for Participants #1 (OT, HRS) and #5 (OT, HRS) and pressure ulcer prevention for Participant #11 (OT, HRS). Regardless of resource setting or program, most participants considered intermediate and

advanced training to be more appropriate in a continuing education setting for practicing clinicians. Nonetheless, all but one participant remarked on their curriculum's insufficient coverage of wheelchair topics and their hope to increase it.

#### ***Pedagogical approaches – "first theoretical... then practical"***

Wheelchair service provision content was distributed throughout the curricula, embedded in a variety of courses, or condensed into one wheelchair-specific course. According to most participants, embedding new wheelchair service provision content into existing courses was more feasible than creating a new course, unless there was the opportunity to create an optional wheelchair-specific course as experienced by Participant #1 (OT, HRS). However, participants expressed that embedding into existing courses limited the breadth and depth of wheelchair content (e.g., assessment only). Several participants also reported having multiple consecutive wheelchair-specific classes embedded within a broader course (e.g., in gerontology or assistive technology courses), which allowed more coverage, albeit still limited in depth. In contrast, Participant #11 (OT, HRS) explained that the wheelchair content was purposively distributed throughout the program in order to cover the wheelchair service provision relative to a variety of diagnoses and/or in a range of environments: "[Wheelchair] modules are within occupational therapy [curriculum], because a lot of things relate [...] it's not easy to say it's only in one place".

Lectures were the most frequently cited pedagogic approach. For the most part, the faculty was responsible for providing the education, but some participants reported also inviting guest lecturers to teach the theory and/or the laboratory sessions. The following quote by Participant 3 (PT, MRS) reflected the consensus of the participants, "I think that would be most pertinent: to have a first approach from the point of theoretical aspects and to have then a practical component". One participant (6, PT, HRS) described providing online [Supplementary material](#) and one participant (14, P&O, MRS) planned to deliver the wheelchair service provision education entirely online in the new online Bachelor program for practicing P&O clinicians pursuing a university degree. Participants also reported using case studies, videos and patient models most frequently as pedagogic strategies. For instance, Participant 1 (OT, HRS) stated, "We gave those case studies at the very beginning of the course and [the students] worked [them] through [each of the WHO 8 steps.] And they switched the case study three times throughout the session, so that [they] had the opportunity to use different chairs and to work through different aspects of different case studies and different diagnoses". Finally, the majority of participants incorporated hands-on, practical components with wheelchairs and related equipment (e.g., cushions and various wheelchair components and accessories) in laboratory/workshops settings, where students simulated wheelchair service during role-play.

Many participants considered mandatory clinical internships, although outside of the wheelchair-specific course or program curricula, to be part of wheelchair service provision education as the students may encounter wheelchair users during the internship. On the other hand, two participants described that their program offered the students opportunities to work directly with wheelchair users within the local community (Participant #2, PT, P&O, LRS) and through mission work abroad (Participant #8, OT, HRS). Interestingly, several participants, only from HRSs, included a "wheelchair user perspective experience" (also known as "a day in a wheelchair") to expose their students to the challenges and the needs of their future patients.

### *Evaluation and feedback – “demonstrate it made a difference”*

All 14 participants reported using evaluations to measure students' competence and to determine their progress in relation to educational goals. Regardless of discipline or resource setting, the vast majority included written and practical examinations. One participant reported that all courses in their program, including the wheelchair service provision education, were tested via web-based student evaluations. In contrast, when questioned about the possible use of an online evaluation format, such as the validated ISWP Wheelchair Service Provision Basic Test, Participant 2 (P&O and PT, LRS) responded, “For the [ISWP Wheelchair Service Provision Basic] online test, because of the [unreliable] network connection [in my environment], maybe [the students] won't be able to answer all the questions before the time goes up. That's why we developed our own [paper-based] questionnaires, so that we have our own [student] results”.

Collectively, student grades were used by most participants to evaluate the effectiveness of the educational strategies used to teach wheelchair education. The selected educational strategies were also assessed in course evaluations completed by students and/or faculty members, as described by Participant 12 (P&O, HRS), “Over the course of the years as we've learned about our strengths and weaknesses, we found that we were missing content on seating systems and wheelchairs. So we added more content to address that shortcoming”. In many cases, student interest and their perceived value of a wheelchair-specific course validated the importance of learning about wheelchair service provision in their professional training.

### *Integration process – “selling a new idea”*

#### *Advocacy*

The first state pertained to advocacy within, or external to, the academic institution to integrate wheelchair service provision education into the curriculum. Advocacy was perceived as essential to circumvent integration challenges such as limited faculty interest, resistance, limited awareness of basic wheelchair service provision and of available resources. Among the variety of factors that facilitated advocacy efforts, for four participants of OT Programs from MRSs and HRSs, opportunities arose to integrate new content during a routine revision of the curricula. For example, for Participant #6 (PT, HRS), the transition from a 2-year Master's PT Program to a 3-year Doctorate PT Program presented a chance to advocate for integration of additional wheelchair service provision education. Generally, participants' expertise in wheelchair provision greatly influenced administrative support and ultimate approval of wheelchair-specific education during advocacy efforts. In LRSs, the promotion of wheelchair service provision education by internationally recognized organizations (e.g., WHO, International Committee of the Red Cross and International Society for Prosthetics and Orthotics) were reported as motivators for advocacy and subsequent support. In HRSs, Participants #1 and #5 (OT, HRS) evaluated student competencies pre- and post-optional wheelchair education, which demonstrated the need for continued optional or even mandatory offering of this wheelchair service provision content. Participant 5 (OT, HRS) described this advocacy strategy well in saying, “It wasn't a big struggle to convince [the faculty] of the benefits and part of [the argument] was that we had a research study that evaluated the outcomes of our extracurricular [wheelchair] boot camp [which] were quite encouraging. So we have evidence to support integrating that into the core curriculum”.

#### *Planning*

Participants described the next state of integration as planning, which included contextual considerations related to governance, human and physical resources. For some participants, the lack of funding perpetuated the lack of human and physical resources to offer comprehensive wheelchair service provision education in the curricula, as described by Participant 13 (P&O, HRS), “We have a limited budget to pay for the time and effort for these adjunct instructors to come in and teach our students. And we have a limited budget and space to purchase and store additional seating systems”. Participants from LRSs described access to educators trained in wheelchair provision as a predominant barrier. In contrast, participants from HRSs reported having the availability of clinical collaborators to teach wheelchair service provision content due to partnerships with local rehabilitation centres and available university funding to pay for external educators. For instance, Participant 6 (PT, HRS) reported, “[Collaboration] was pretty key for the things we were able to do in our program. [...] But certainly, if I didn't [have these collaborators], that would be a key thing to understand how to reach out and get local supply people, so in our case, our suppliers and manufacturer representatives, because they are very willing to bring in demos [wheelchairs]”. Participants reported that while useful to counteract the missing resources, such collaborations only occurred if the organizations and/or local rehabilitation clinics offering wheelchair service provision already existed in the context setting. Hence, participants from LRSs primarily networked with existing NGOs in their setting to help overcome situations of limited physical resources (i.e., lab space and wheelchairs for students to practice).

Fuelling the issue of time constraints were limited funding and access to human and physical resources. For instance, participants described that there was not sufficient funding (i.e., salary) to work on the integration of wheelchair service provision education on top of regular responsibilities. Participants also reported how time constraints limited the number of teaching hours for wheelchair topics, and restricted the time that educators could dedicate to create or to modify any teaching material.

#### *Course development and delivery*

The next state was course development and delivery. Based on the parameters set by the governing bodies at different levels, educators either used existing resources or developed the teaching material most relevant to the students in their context. The content, whether original and/or evidence-based open-source materials and the pedagogic approaches had to be approved by the academic and/or faculty committee, as described by Participant 5 (OT, HRS), “Once [the course] is built and all its [pedagogic] strategies are established [...], the committee of the faculty would be in charge of the final approval of the [course]”.

The duration of wheelchair education ranged from 3 h distributed across the curriculum to 40 h, with the latter being described by participants, mostly from LRSs, who taught with the full basic WHO WSTP. Due to the time constraints within curricula, some participants reported reduction in content or practical experience, but in the case for Participant 5 (OT, HRS), an optional wheelchair workshop (i.e., wheelchair skills assessment and training) was approved to take place on the weekend. Other strategies to circumvent the time constraints without removing an excessive amount of the wheelchair education content were to develop online modules and/or optional courses. As long as the wheelchair-specific course was developed according to the regulations set by the governing bodies (e.g., education standards), the

academic and/or faculty committee approved the course to be implemented within the curriculum.

### **First-time implementation**

The next state was the first-time implementation of the wheelchair service provision education. Although only one participant was at this state at the time of data collection, a commonality among the participants was the wealth of information acquired from the first-time implementation as measured by (1) the students' academic performance, (2) the efficacy of the course's pedagogic approaches and (3) the course evaluations whether by the students in a formal process or by the collaborators and the instructors asking for and receiving informal feedback. Participants described how this state helped to understand how to further integrate and to seek solutions and additional support necessary to improve the wheelchair service provision education offered. For example, Participant 7 (P&O, LRS) planned to assemble an evaluation report on their first-time implementation experience in hopes of learning what could be improved in their wheelchair service provision course.

### **Improvement**

The final, but perpetual, state of the integration process was improvement. Similar to the previous state, participants reported being able to obtain valuable information from the course experience every time it was offered. Participant 13 even suggested learning about the clinical impact of the wheelchair service provision education in order to improve the curricula in saying, "Perhaps a way to do that is to seek advice and input from our clinical community members and our alumni. Those students had experienced the curriculum and are now in clinical practice, one way to determine what we need is to ask them – what do we need?" According to participants, with the feedback, obtaining approval to revise a wheelchair-specific course and/or any wheelchair content within the curriculum was generally an easy process. As suggested by Participant 6 (PT, HRS), "Once you have a course into the system, it is not too difficult to make some modifications to that course, especially around content. It is a little harder if you wanted to add hours or add credits or those kinds of things, but just making changes in content is actually relatively easy". For some participants, notably in the MRSs and HRSs, the academic committee's acknowledgement of the educators' expertise contributed to the ease of improving an existing course, leaving the modifications to the discretion of the educator of the wheelchair-specific course.

## **Discussion**

This study offered a more in-depth description of the wheelchair service provision education offered in 14 rehabilitation university programs and the experience of integration into curricula from the educators' perspective. Represented in Figure 1, the dynamic context-dependent integration of wheelchair service provision education in curricula contains the three major themes (*impact of context, current and planned wheelchair education and integration process*) for discussion.

### **Impact of context – “the picture is quite different depending on where you live ...”**

All study participants expressed that context is an important factor when considering the integration of wheelchair service provision content into their program. These findings are consistent

with the results of McSweeney and Gowran (2017) in their scoping review on wheelchair service provision education and training in LRSs and lower MRSs. Indeed, consideration of the contextual landscape is critical for the development of programs that address local population needs and the training of health care providers. Educators must take into account the government and policies, local historical and current culture, and the health system [7].

The needs of the local population dictate the demand for professionals to provide wheelchair service provision. Therefore, local health training programs and schools must train and supply professionals to fill this gap. McSweeney and Gowran (2017) cited that several articles confirmed that lack of professional differentiation or specific roles contribute to the difficulty in providing both appropriate education and wheelchair service provision. The need for local skilled workforce for assistive technology service provision, including wheelchairs, forms one of the bases of the Global Cooperation of Assistive Technology (GATE) initiative led by the WHO. Through GATE, the WHO aims to make appropriate assistive technology service provision accessible for all those in need [25]. Thus, concordant to the findings of this current study, education and training were among the main strategies identified in the first global research, innovation, and education on assistive technology (GREAT) summit [26]. Therefore, while wheelchair service provision education needs to be integrated into rehabilitation professional programs, universities will need to ground their wheelchair content in the local population needs in order to best bridge the gap between current education and optimal, and contextually appropriate, wheelchair service provision.

In terms of governance, our results suggest that participants from LRSs perceived the implication of geopolitical governance more than participants from HRSs, who themselves appeared to be more concerned with rehabilitation professional regulatory bodies. While participants in LRSs speculated that geopolitical governmental policies and guidelines advocating for wheelchair service provision would greatly motivate the integration of wheelchair education into rehabilitation professional programs, the lack of wheelchair education and training was identified as a major factor hindering wheelchair service policy implementation and a Rights-Based Approach [6]. Thus, efforts from both the educational institutions and relevant governing bodies are necessary to promote the integration of wheelchair service provision education. Indeed, current education standards vary across rehabilitation professions. For instance, in the World Federation of Occupational Therapists Minimum Education Standards the topic of wheelchair service provision is included briefly under *The Person-Environment-Occupation Relationship & its Relationship to Health, Well-being and Human Rights* section of *Essential Knowledge, Skills & Attitudes for Competent Practice* as theoretical knowledge required for “managing disruption to body structure or function to preserve the potential to participate in occupation, specifically *seating systems to maintain posture or reduce the effects of pressure*” [27]. In contrast, the International Society of Prosthetics and Orthotics (ISPO) in conjunction with the WHO released the newest educational standards, which state specifically that P&O professionals should have fundamental knowledge of wheelchairs [28]. The addition of wheelchair-specific content to the ISPO Education standards reflects global efforts to enhance the quality of life of people living with disability through the use of appropriate assistive technology by first integrating necessary education into the rehabilitation professional program curricula [26].

An available supply of wheelchairs is also key for improving wheelchair service provision education process. Nearly all



**Table 3.** The states of integration of wheelchair service provision education in curricula.

State of integration	Description
Advocacy	Raising awareness of the need for wheelchair service provision education into the professional rehabilitation curricula for approval of wheelchair-specific course
Planning	Identifying resources and strategies to manage requirements and constraints in the integration process
Course development and delivery	Assembling components of the wheelchair-specific course based on the plan, ensuring the context-specificity of course content and delivery for approval of wheelchair-specific course
First-time implementation	Offering the newly integrated wheelchair service provision course as planned to the students. Evaluating (1) the students' academic performance, (2) the efficacy of the course's pedagogic approaches and (3) course evaluations whether by the students in a formal process or by the collaborators and the instructors giving informal feedback.
Improvement	Improvement of the wheelchair service provision course based on to the feedback and to the student performance

participants mentioned the need for available equipment to teach wheelchair education in a practical manner. These data highlight the way integration of wheelchair education is intended to directly translate into clinical practice in the local setting. Regardless of resource settings, our findings suggested that most teaching equipment availability were the result of collaborations and partnerships among health care professionals from different disciplines and other experts in wheelchair provision (e.g., suppliers, education specialists). While the university programs benefit from donated and/or loaned material, suppliers and organizations are able to network with or expose rehabilitation professional students to their equipment, which ultimately enhances wheelchair service provision in the local setting. The Consolidating Logistics for Assistive Technology Supply and Provision (CLASP) initiative led by the UCP Wheels for Humanity, and funded by USAID, aims to be a reliable source of a reliable source of a wide range of wheelchair products. Thus, initiatives like CLASP may also enhance the access to appropriate wheelchair service provision by simplifying the supply chain of equipment [29]. As shown in this current study, the involvement of supply chain of equipment and service delivery institutions appears to be an excellent way to facilitate integration and may even highlight the positive benefits of interdisciplinary work to rehabilitation professional students.

#### **Current and planned wheelchair education – “the WHO packages.... as a benchmark”**

As expected based on the model of curriculum development for medical education by Kern et al. [30], the current and planned education developed by the faculty for wheelchair service provision education were based on the current scope of practice and wheelchair service delivery within the context setting. However, following this logic, wheelchair education would not be part of the curriculum in settings where wheelchair service delivery is lacking, despite the needs of the population. In other words, this way to gauge the extent of wheelchair education to be integrated into the curricula may be problematic as the lack of wheelchair service provision is arguably the first and foremost reason to provide wheelchair education in academic rehabilitation programs. This situation would be rather different had there been stronger government commitment, whether geopolitical or professional governing bodies, to train rehabilitation personnel as is the goal of the GATE initiative in their policy directives [25].

Consistent with our findings, studies in HRS on existing wheelchair education found that most educational institutions mainly taught the assessment and user training steps of the WHO recommended 8-step wheelchair service provision process [31–33]. Our results suggest that the distribution of the wheelchair service provision content across the curriculum, embedded into existing courses not specific to wheelchair content, is a major contributor to the scope of education that is provided. In fact, despite the increase of courses teaching assistive technology in academic

rehabilitation programs, particularly in HRSs, wheelchair-related topics are but one single section within these courses [31–36]. Therefore, the increase in assistive technology courses in rehabilitation program curricula cannot be interpreted as an increased coverage of wheelchair service provision as recommended by the WHO 8-step model. Both the literature and our participants' comments highlight the need to increase the coverage beyond the assessment and user training steps in their curricula to better respond to the gap in wheelchair service delivery in clinical settings, regardless of resource settings and professions.

Consistent with previous studies, our sample of participants used evidence-based, open-source resources such as WHO WSTP [4] and WSP [15,31,32,37]. Variations are generally introduced in the wheelchair education content in order to better reflect the resources within and the constraints of their own context setting [7,11]. While the highly regarded reputation of the WHO facilitates the integration of WHO WSTP, faculty with less wheelchair expertise may be reluctant to adapt its content to their own context. This reluctance to adapt corresponds to the six rehab-workforce challenges framework, whereby a proposed solution is for local universities to assume the responsibility to adapt its course material to its own context [9]. Regardless of wheelchair education content and teaching material used, perhaps one way to confirm basic wheelchair service provision competency globally could be to administer the validated ISWP Wheelchair Service Provision Basic Test that is available online and in print and in 14 languages [7,38].

#### **Integration process – “selling a new idea”**

Regardless of an academic rehabilitation program's education level, wheelchair service provision education is a relevant subject. Within the process of integration of wheelchair service provision education in curricula (Table 3), the states of advocacy, planning and course development and delivery presented remarkably more barriers and required more facilitators than the other states. Advocacy for wheelchair education occurred in at least three levels: (1) the educators, (2) the program and/or faculty and (3) the professional governing bodies and/or government. As discussed in the theme of context, the professional governing bodies and/or government have the widest reach and most impactful influence on the integration of wheelchair service provision in curricula. However, recent WHO and United Nations reports identified a general lack of awareness and understanding on the necessity of rehabilitation for people living with disability [39,40], which may explain the limited awareness for the need of wheelchair education previously and presently described [11]. Knowing that in the planning state, an appreciation of the need for wheelchair education serves to facilitate integration, the ISWP has created a Wheelchair Provision Policy Advocacy Kit to better circumvent issues relating to the lack of advocacy (<http://pak.wheelchairnet-work.org/>). Nonetheless, limited time within the curricula is often

identified as a concern, which is consistent with other studies about integration of various new topics (e.g., thrust joint manipulation in PT curricula, genetics in OT curricula) in rehabilitation program curricula [17,18,41–43]. While the wheelchair-specific study by Best et al. (2015) also cited time as a barrier, our results now expand on the consequences and offer potential solutions (Table 2).

Based on the results of this current study, the ISWP team developed and will continue to evolve ISWP's Seating and Mobility Academic Resource Toolkit (SMART; <http://smart.wheelchairnetwork.org/>) to facilitate the integration of comprehensive wheelchair service provision education into curricula. Examples of resources offered in SMART include case studies, recommendations for resource allocation, advocacy and policy development recommendations [44]. Additionally, academic institutions are encouraged to share their wheelchair service provision teaching and testing material in SMART (e.g., syllabi, PowerPoint slides, practical lab guides, theoretical evaluations) to help one and another facilitate the integration of wheelchair service provision education into curricula. Future directions include an investigation on the efficacy of SMART as an interactive community of practice for academic settings and an exploration of the impact of integration on clinical practice in settings with poor or little wheelchair service provision. Furthermore, a similar study to obtain the perspective of students or alumni from academic rehabilitation programs

## Limitations

This study has several limitations. A purposive sample of representatives volunteered to participate ( $n = 14$ ), which is a small sample considering the number of academic rehabilitation training programs globally. Nevertheless, this study provides insights across geographic, resource levels and type of rehabilitation programs. The majority of participants were professors advocating for and/or teaching wheelchair content within their program and may have been more enthusiastic about wheelchair integration may also be seen as a limitation. Furthermore, interviews were limited to English or Spanish, thus limiting the subject pool to those who speak these languages. As the participants were not asked to check their respective transcribed interview, only the bilingual authors verified any possible issues of translation versus interpretation. Despite study limitations, the participants come from 11 different countries of different resource settings, providing important information on wheelchair education integration worldwide.

## Conclusion

This study provides an in-depth description of wheelchair service provision education across rehabilitation disciplines and resource settings. It illustrates the importance of context-dependent integration of wheelchair service provision education into academic rehabilitation programs to meet the needs of wheelchair users. This work has informed the development of ISWP's Seating and Mobility Academic Resource Toolkit (<http://smart.wheelchairnetwork.org/>), the purpose of which is to assist the integration of context-relevant wheelchair service provision education in academic rehabilitation programs worldwide.

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