Availability, importance, and accessibility of postgraduate education for Orthotists and Prosthetists in South Africa: A mixed method study.

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Thesis presented in fulfilment of the requirements for the degree Masters in Human Rehabilitation Studies

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Declaration

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Abstract

Background: Orthotists and Prosthetists play an integral role during rehabilitation of many persons with impairments through the provision of orthotic and/or prosthetic devices that assist in prevention of complications, functional restoration, community integration and ultimately improved quality of life. The role of Orthotists and Prosthetists as rehabilitation team members are often times required for a lifetime, even after other team members have completed their roles. To date, in South Africa, there are three educational institutions that offer pre-graduate training for the orthotic and prosthetic profession.

The **aim** of this study was to explore the availability, importance, and accessibility of postgraduate education for Orthotists and Prosthetists in South Africa

The **objectives** were to:

- Identify generic postgraduate education available for Orthotists and Prosthetists in South Africa
- Determine participant's opinion on the importance of postgraduate education for Orthotists and Prosthetists in South Africa
- Determine the postgraduate education needs of Orthotists and Prosthetists in South Africa
- Identify the barriers to participating in postgraduate education by Orthotists and Prosthetists in South Africa
- Determine the format of postgraduate education preferred by Orthotists and Prosthetists in South Africa

Methods: A mixed method phased approach was used. Phase 1 was quantitative. Data was collected via email questionnaires from 47 randomly sampled participants. In this regard, descriptive analysis was done. In phase 2, qualitative data was a collected from eight purposively sampled participants with open ended emailed questions and the thematic method was used to analyse the data. The findings from the two phases were triangulated in an integrated discussion.

Findings: The findings showed that participants viewed postgraduate education in orthotics and prosthetics as important and needed. Participants preferred the programme to be offered in

a format that value different learning preferences to be accessible to all. Participants had no access to postgraduate specific orthotics and prosthetics education and limited generic programme access in South Africa. This led to decreased participation in postgraduate education by orthotist and prosthetists. It is recommended that one of the three tertiary institutions currently offering pre-graduate education in orthotics and prosthetics in South Africa develop discipline specific postgraduate education programmes in orthotics and prosthetics that is internationally recognised. The existing generic programmes suitable for orthotists and prosthetists in South Africa must be identified and developed to become more inclusive of orthotists and prosthetists educational needs. The quality and effectiveness of pre-graduate orthotic and prosthetic education in South Africa should be studied.

Key words: Postgraduate education, orthotics and prosthetics, South Africa

Abstrak

Agtergrond: Ortotiste en Prostetiste speel `n belangrike rol in die rehabilitasieproses van persone met gestremdhede deur die verskaffing van orthoses en/of prostheses. Die hulpmiddels kan help om sekondêre komplikasies te voorkom, funksie te verbeter, gemeenskapsintegrasie te bewerkstellig en lewenskwaliteit te bevorder. Ortotiste en Prostetiste speel soms `n lewenslange rol in die lewe van `n persoon met `n gestremdheid. Tans in Suid-Afrika is daar drie opvoedkundige instansies wat voorgraadse studies aanbied ten opsigte van die Ortotika en Prostetika professie.

Die **doel** van hierdie studie was om die beskikbaarheid, belangrikheid en toeganklikheid van nagraadse opleiding in die Ortotika en Prostetika professie in Suid-Afrika te ondersoek.

Die **doelstellings** was om:

- Die nagraadse opleiding tans beskikbaar in die Suid-Afrikaanse Ortotika en Prostetika professie te bepaal
- Die deelnemers se mening oor die noodsaaklikheid van nagraadse opleiding vir Ortotiste en Prostetikuste in Suid Afrika te bepaal
- Die behoeftes te bepaal ten opsigte van nagraadse Ortotika en Prostetika opleidingsprogramme
- Te bepaal wat die hindernisse ten opsigte van die deelname aan nagraadse Ortotika en Prostetika opleiding in Suid -Afrika sal wees
- Die voorkeure van die Ortotiste en Prostetiste te bepaal ten opsigte van die tipe en formaat van nagraadse opleiding

Metode: `n Gemengde navorsingsmetode was gebruik. Fase 1 was kwantitatief. Data was ingesamel deur middel van epos vraelyste wat deur 47 lukraak ge-identifiseerede deelnemers voltooi is. `n Beskrywende analise was in hierdie verband gedoen. In fase 2 was kwalitatiewe data deur middel van oop vrae ingesamel van agt doelgerig geselekteerde deelnemers en die data is tematies geanaliseer. Die bevindinge van die twee fases was teenoor mekaar gestel en geintegreer in ‘n bespreking.

Bevindinge: Die bevindinge het getoon dat die deelnemers nagraadse opleiding in ortotika en prostetika belangrik ag. Die deelnemers het verder ook verkies dat die nagraadse opleiding wat

in ortotika en prostetika aangebied word, in verskillende formate aangebied moet word om die toeganklikheid van sulke programme te bevorder. Die deelnemers het geen toegang tot nagraadse ortotika en prostetika spesifieke opleiding nie en het beperkte toegang tot generiese opleidingsprogramme in Suid-Afrika. Dit veroorsaak `n afname in die deelname aan nagraadse opleiding in ortotika en prostetika. Daar was voorgestel dat een van die drie tersiêre opleidingsinstansies wat voorgraadse opleiding in ortotika en prostetika aanbied, `n nagraadse opleidingsprogram vir Ortotika en Prostetika in Suid-Afrika moet ontwikkel wat internasionaal erken sal word. Die huidige generiese opleidingsprogramme wat geskik sal wees vir ortotika en prostetika in Suid-Afrika, moet geidentifiseer word, en bygestaan word om meer inklusief teenoor ortotiste en prostetiste te wees. Verdere studies is nodig om die kwaliteit en effektiwiteit van voorgraadse opleiding in ortotika en prostetika in Suid-Afrika te bepaal.

Sleutelwoorde: Nagraadse opleiding, ortotika en prostetika, Suid-Afrika

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Glossary of Terms

Prosthetist/Orthotist:	"A health care professional who uses evidence-based practice to provide clinical assessment, prescription, technical design, and fabrication of prosthetic and/or orthotic devices. Prosthetists/Orthotists work independently or as part of the health professional team. They set goals and establish rehabilitation plans that include prosthetic/orthotic services and clinical outcome measures. The profession aims to enable service recipients so they have equal opportunities to fully participate in society" (ISPO, 2018 p 11).
Prostheses and orthoses:	"Externally applied devices and products used to assist people with physical impairments or functional limitations, to improve their functioning and increase their potential to live healthy, productive, independent, dignified lives" (WHO, 2017 p.xxiii).
Prosthesis:	"An externally applied device used to replace wholly or partly an absent or deficient limb segment (arm or leg)" (WHO, 2017 p.xxiii).
Orthosis:	"An externally applied device used to support or modify the structural and functional characteristics of the neuromuscular and skeletal systems (such as arms, legs and the spine)" (WHO, 2017 p.xxiii).

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List of Acronyms

AP	Assistive product
APOSADC	Association of Prosthetics and Orthotics Southern African Development Community region
CPD	Continuous Professional Development
DUT	Durban University of Technology
EBP	Evidence based practice
EC	Eastern Cape
FS	Free State
GP	Gauteng
HPCSA	Health Profession Council of South Africa
ISPO	International Society of Prosthetics and Orthotics
KZN	KwaZulu Natal
LP	Limpopo
MP	Mpumalanga
NC	Northern Cape
NW	North West
O&P	Orthotists and Prosthetists
SA	South Africa
SAOPA	South African Orthotics and Prosthetics Association

TATCOT	Training Center for Orthopaedic Technologists
TUT	Tshwane University of Technology
WC	Western Cape
WHO	World Health Organization
WSU	Walter Sisulu University

Chapter 1

Introduction to the study

1.1. Background

Orthotists and Prosthetists (O&Ps) play an integral role during rehabilitation of many persons with impairments through the provision of orthotic and/or prosthetic devices that assist in prevention of complications, functional restoration, community integration and ultimately improved quality of life. Orthotists & Prosthetists are part of the rehabilitation team and depending on the person`s orthotic and prosthetic needs, can play a role for a certain period of time during rehabilitation,
e.g. providing a patient with elbow crutches or a splint for mobility and ambulation while a fracture heals. On the other hand, O&Ps might be involved throughout a person`s life, even after other rehabilitation team members have completed their involvement, e.g. lifetime prosthetic fabrication, maintenance and care after a lower limb amputation (Lusardi, Jorge, & Nielsen, 2013; Mduzana, Tiwari, Ned & Chikte, 2020; Boone, 2020)

Accredited and recognised orthotics and prosthetics teaching and learning in South Africa (SA) has, for many years, been provided at the Tshwane University of Technology (TUT) with the highest qualification being a National Diploma in Medical Orthotics and Prosthetics. South Africa has seen the inception of a B-tech degree at the TUT in 2004. In 2013, the Durban University of technology (DUT) saw their first student intake for a Bachelor of Health Science degree in Medical Orthotics and Prosthetics. There is also the expectation of a bachelor's degree in orthotics and prosthetics being offered at Walter Sisulu University (WSU), but to date, no students have qualified from this institution (Mduzana *et al*., 2020).

Currently, there is no accredited higher education institution which offers postgraduate courses or masters and doctoral programmes in orthotics and prosthetics in the country or on the African continent (Mduzana *et al*., 2020). Short courses and workshops are normally presented at congresses and seminars where professionals are awarded points for continuous professional development (CPD). However, these do not culminate in a formal qualification and do not involve research activities that can develop much needed evidence on orthotic and prosthetic service delivery in Africa and South Africa (Aduayom-Ahego, 2017; SAOPA, 2018; HPCSA, 2018; Magnussen, 2019).

The lack of orthotic and prosthetic specific postgraduate learning options in South Africa forces practitioners in this field to pursue further qualification opportunities in related fields like public health and rehabilitation or to study orthotics and prosthetics internationally. The advantage of generic programmes is that O&Ps can enhance their knowledge, skill, and training within the professional society by having postgraduate qualifications in alignment with their colleagues in rehabilitation services in South Africa. The disadvantage of generic postgraduate qualifications is that core orthotic and prosthetic knowledge and skills are not advanced and research from such programmes might not directly develop the body of profession specific evidence. International training programmes are expensive, in a foreign language, and lack specific focus on local environmental and cultural requirements (Harkins, McGarry & Buis, 2012; Aduayom-Ahego, Ehare & Kpandressi, 2017; Magnussion, 2019).

1.2. Problem

Recent research by Magnusson (2019) and Aduayom-Ahego *et al*. (2017) suggest that Africa must develop postgraduate education programmes in orthotics and prosthetics. Similarly, Mduzana *et al*. (2020:11) recommended, "an upscaling of training by higher education institutions". However, upscaling of training and development of programmes is dependent on knowledge of the requirements of South African O&Ps in this regard. This knowledge is currently lacking.

1.3. Motivation

As an O&P myself living in South Africa, I wanted to pursue postgraduate profession specific studies and was confronted with no available options locally. Having available options locally would be beneficial to Orthotists and Prosthetists professionals as they would have the option to pursue postgraduate education. Furthermore, the associated tertiary institutions would benefit financially as O&Ps in pursuit of profession specific postgraduate education would not necessarily need to go study abroad to study such qualifications. When seeking generic options, there were limited options available due to the practical nature of the profession. The profession specific international studies came with challenges of its own such as costs, travel or distance, time, and language barriers. This experience, I learnt, was not unique to me. The discussion on the availability, and accessibility of postgraduate education in South Africa and Africa had become an ongoing discussion at most orthotic and prosthetic conferences, forums and meetings. I have been in the profession for 10 years and, to date, little has changed in terms of postgraduate education for Orthotists and Prosthetists in South Africa. My aim was to study and describe the current status quo and possibilities regarding postgraduate education for Orthotists and

Prosthetists in South Africa.

1.4. Significance

To develop orthotics and prosthetics as a profession, and ensure evidence based orthotic and prosthetic service delivery, O&Ps should be encouraged to complete postgraduate education programmes (Taheri, Changiz, & Tifighi, 2019a; Ramstrand & Brodtkorb, 2008). The World health Organization (2018) states that education in orthotics and prosthetics is increasingly important globally. Thus, it is important to identify and understand factors that play a role in orthotics and prosthetics education (Aduayom-Ahego & Ehara, 2016; Aduayom-Ahego, 2017 & Magnusson, 2019). However, there is limited documented research evidence on this topic from low- and middle-income countries (Magnusson, 2019; McDonald, Kartin & Morgan, 2020). McDonald *et al*. (2020) call for the conduction and publication of high-quality research in this field with a view of adding to the global conversation on, and provision of orthotic and prosthetic education. It is hoped that this study can make a small contribution towards answering that call.

1.5. Theoretical framework

This study uses Gidley, Hampson, Wheeler & Bereded-Samuel (2010) degrees of social inclusion in postgraduate education as presented in figure 1.1 as framework.

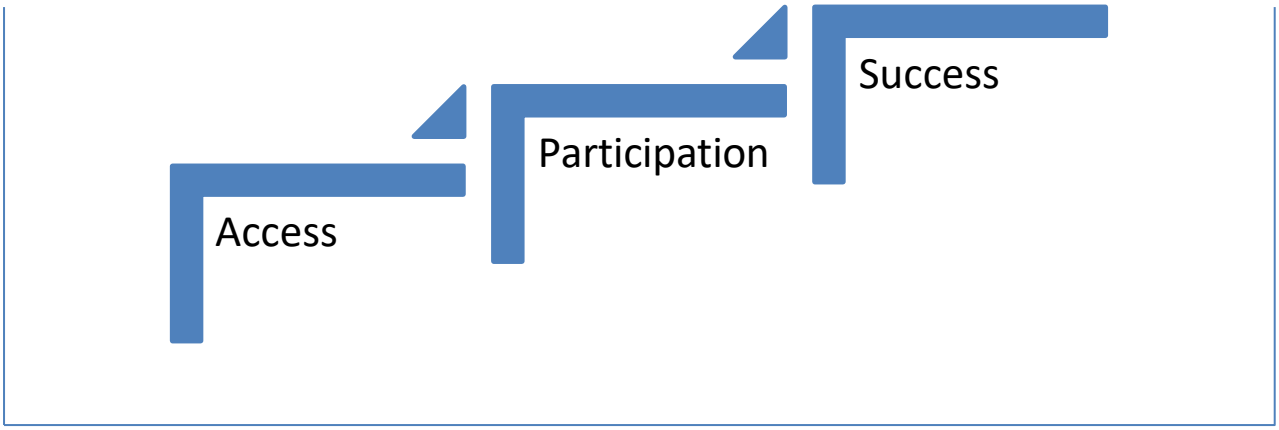

Figure 1. 1: Degrees of social inclusion in postgraduate education (Adapted from Gidley *et al.*, 2010)

Access represents the narrowest understanding of social inclusion in postgraduate education; only indicating that an individual can get accepted by an institution or a programme of higher learning. Participation takes a step up from being merely present to engaging in the programme and actively learning and developing. Success, the final degree, means the individual has been empowered and his/her potential maximised (Gidley *et al*., 2010).

1.6. Summary

This chapter introduced the background of the study focusing on the current situation regarding postgraduate education for orthotists and prosthetists in South Africa. Higher education institutions which offer orthotics and prosthetics courses in the country were introduced. The lack of orthotics and prosthetics specific postgraduate education and limited available and accessible generic postgraduate studies in South Africa were explained. The research problem, motivation, significance, and theoretical framework were also presented.

1.7. Study outline

The study was introduced with a brief background, research problem, motivation, significance and theoretical framework in chapter 1.

Chapter 2 focused on the current literature on the topic and provided an overview on the importance of assistive technology, exploration of various policies that guide assistive technology services in general and orthotics and prosthetics specifically. It continued to explore postgraduate education policies in South Africa, postgraduate education and research in orthotics and prosthetics, barriers to postgraduate orthotics and prosthetics education in Africa and South Africa as well as the preferred modes of postgraduate education.

In chapter 3, an explanation of the methods was provided to motivate the use of a phased mixed method study design. Sampling, recruitment, data collection and analysis methods were explored as well as ethical considerations.

The quantitative results (phase 1) were presented in chapter 4 using graphs and tables. Chapter 5 presented qualitative (phase 2) findings, which further explored phase 1 findings though semi structured interviews.

In an integrated discussion, the data from phase 1and 2 findings was triangulated and presented in chapter 6. From this, the conclusion and the recommendations of the study was drawn which is presented in chapter 7.

Chapter 2

Literature review

2.1. Introduction

A literature search was done through Google Scholar and the University of Stellenbosch online library services. The literature search was performed using key terms, "postgraduate education in orthotics and prosthetics; research in orthotics and prosthetics; postgraduate education"; key terms were matched with South Africa, Africa and low- and middle-income countries.

This chapter starts with an overview on the importance of assistive technology, then explores the various policies that guide assistive technology services in general and orthotic and prosthetic services specifically. After a short exploration of availability of orthotic and prosthetic services it proceeds with an overview of postgraduate education policy in South Africa, postgraduate education and research in orthotics and prosthetics, barriers to postgraduate orthotics and prosthetics education in Africa and South Africa as well as the preferred modes of postgraduate education.

2.2. Assistive products: An overview

Assistive products (AP), including orthoses and prostheses, can enable people with various impairments (including persons with chronic conditions and the aging) to live healthy, productive, independent, and dignified lives. AP improves functioning and is often essential for participation in education, the labour market and civic life. AP can reduce the need for formal health and support services, long-term care, and caregiver burden. Not having a needed AP often leads to exclusion, isolation, and poverty, which increases the impact of disease and disability on a person, their family and society (UN, 2018). Persons with impairments often require assistive products to achieve the sustainable development goals (SDGs) (UN, 2018). Internationally, 68% of people do not have access to the AP that they need (UN, 2018). Between 25% and 65% of South Africans do not have access to AP that they need (Visagie, Scheffler, Seymour & Mji, 2020).

While reliable data is not available in many countries, it is estimated that 0.5% of a population require orthotic and prosthetic devices and that this need is often unmet in developing countries (UN, 2018). The numbers are anticipated to increase as disabling conditions continue to trend across the globe because of population growth, ageing, chronic conditions, communicable

diseases, malnutrition, natural disasters, war, landmines, violence, road traffic, and domestic and occupational injuries (WHO, 2005; Harkins *et al*., 2012).

2.3. Policy guiding assistive technology services and education

Over the decades, and exponentially so since 2010, there has been ongoing publications and agreements on access to assistive technology for persons with disabilities (UN, 2018; Desmond, Layton, Bentley, Boot & Borg, 2018; Layton, MacLachlan, Smith & Scherer, 2020; Smith, Scherer, Cooper, Bell & Hobbs 2018). These started with The Standard Rules on the Equalisation of Opportunities for Persons with Disabilities in 1993, which were followed by the Convention of Rights of Persons with Disabilities (CRPD) (UN, 2006). Both are overarching documents that focus on the rights of persons with disabilities. In the CRPD, articles 4, 9, 20, 21, 26, 29 and 32 refer to different types of AP that can assist with the promotion of equality and inclusion. The WHO world report on disability exposed the poor access to appropriate AP many persons with disabilities experienced (WHO, 2011). In 2014, the WHO Global Cooperation on assistive technology (GATE) was established with the purpose to improve access to assistive products globally (WHO, 2014). GATE developed a research agenda for improving access to high quality, affordable assistive technology (WHO, 2017a) and a priority assistive product list (APL) (WHO, 2017b). The APL of 50 products includes orthoses and protheses, such as club foot braces, upper limb, lower limb and spinal orthoses as well as lower limb prostheses. Also, in 2017, the WHO Global Research, Innovation and Education in Assistive Technology (GREAT) Summit that culminated in the publication of five position papers on assistive technology services and products was held (MacLachlan, Banes, Bell, Borg & Donally, 2018; Smith, Scherer, *et al*., 2018; Desmond et al., 2018; De Witte, Steel, Gupta, Ramos & Roentgen, 2018; Smith, Gowran, Mannan, Donnelly & Alvarez, 2018). The World Health Assembly's resolution on Improving access to assistive technology (EB142.R6) A71/21 followed in 2018. A year later, the Global Alliance of AT Organizations (GAATO) was launched (2019) and a Global Report on Assistive technology is to be released in 2022. These documents, agreements and alliances all have the purpose to increase access to appropriate assistive products and thus help improve lives of persons with disabilities (UN, 2018., Lemaire, Supan & Ortiz, 2018; Smith, Scherer *et al*., 2018; Layton *et al*., 2020).

Specifically, in the field of O&P, the WHO, the International Society of Prosthetists and Orthotists (ISPO) and the United States Agency for International Development (USAID),

developed standards (WHO, 2017c) and an implementation manual (WHO, 2017d) for countries to use in developing or strengthening essential, affordable, accessible, effective, safe prosthetic and orthotic services of high quality. By using these standards and implementation manual a government can develop national policies, plans and programmes of the highest standard for provision of orthotic and prosthetic services (Lemaire *et al*., 2018)

The standards include recommendations on education and training. They recommend that Orthotists and Prosthetists are trained at the same level as other rehabilitation professionals and that orthotists and prosthetists technicians are trained at the same levels as other rehabilitation professional groups` assistants. These different levels of training should help to ensure that service needs are met in all settings and at all levels. Training programmes should be planned on a continuum that allow progress from one level to the next to allow continued professional development (WHO, 2017c). Higher and postgraduate education should be available to all those in the O&P profession who wish to advance their learning. This training should be parallel to expansion of services so that trained professionals have employment opportunities (WHO, 2017c).

In addition to the above standards and guidelines, ISPO developed global education standards for orthotic and prosthetic services. The education standards provide guidelines on the minimum requirements for training of O&P professionals and O&P technicians. It can be used to effect change in curricula and ensure training and education meets minimum required standards. This allows for the development of a competent workforce that can deliver services of a high quality. It also encourages standards development for advancement of prosthetic and orthotic education (ISPO, 2018).

Currently in Africa, there are five ISPO accredited orthotics and prosthetics programmes (Aduayom-Ahego *et al*., 2017). The training programmes from TUT and DUT in South Africa are accredited locally, but not by ISPO. These programmes are guided by the health professions act 56 of 1974 and regulated by the HPCSA to meet the minimum standards of training and education required for health care professionals.

Tshwane University of Technology is in the process of applying for ISPO accreditation for their Bachelor of Health Science in Medical Orthotics and Prosthetics (BHSc in MOP) degree programme. The BHSc in MOP is a new qualification currently being implemented and is expected to be ISPO accredited by 2023. The accreditation will coincide with the graduation

of the first cohort of students to complete the 4-year degree programme.

South Africa has overall rehabilitation guidelines in the form of the National Department of Health`s Framework and strategy for disability and rehabilitation services in South Africa (NDoH, 2016). This document focusses on decentralisation of services with referral pathways to ensure that more complex needs are addressed. It specifically states that orthotic and prosthetic services should be available in the community setting (NDoH, 2016). It also has as one of its goals improved access to appropriate assistive technology. However, the outcomes for this goal i.e. the revision (due March 2017) and implementation of the revised "Guideline on Provision of Assistive Devices" (due March 2020) have not been achieved. Considering the findings by Mduzana *et al*. (2020) that 50% of O&Ps in South Africa are practicing in Gauteng or the Western Cape Province, it seems as if decentralisation has also not been achieved.

2.4. Availability of orthotic and prosthetic service providers

According to the WHO standards for prosthetics and orthotics, between five and ten orthotists/prosthetists are necessary to provide services for every 1 million people (WHO, 2017). Some high-income countries achieve and even surpass this requirement, but in Africa and other low- and middle-income areas of the world a dire shortage of O&P professionals are common (WHO, 2017). South Africa surpasses the required number with 0.09 O&P professionals for every 10 000 people in South Africa (Mduzana *et al*., 2020).

However, O&P professionals in South Africa are unevenly distributed among gender and population groups. Men accounts for 73% of O&Ps in the country. Although there is a steady growth in the number of O&Ps across population groups, white males still dominate the profession (Mduzana *et al*., 2020). O&Ps in South Africa also tend to be located in urban areas. More than 70% of South African O&Ps practice in Gauteng (37.5%), KwaZulu Natal (21%), and the Western Cape (13.4%) (Mduzana *et al*., 2020). It is unsure what percentage of service providers are employed by the government and thus provide services to the bulk of the country's citizens.

2.5. Postgraduate education and research

Postgraduate studies and research opportunities are provided by recognised institutions of higher learning. Admission requirements to postgraduate programmes differ from one institution to another, but typically requires the completion of a bachelor's degree or a diploma (Mutala, 2009; Abiddin & Ismail, 2014). On completion of postgraduate studies, graduates can

be awarded a generic or discipline specific qualification depending on their chosen programme and research path (Mutula, 2009).

Postgraduate studies are aimed at enhancing and empowering critical thinking skills and to facilitate personal and professional growth and development among students (Abiddin & Ismail, 2014). The main aim of postgraduate research is not to only produce ground-breaking innovations or extend knowledge but to also allow graduate students to learn how to undertake a systematic investigation based on work done by peers in their field and extend or add this knowledge (Mutula, 2009).

In South Africa, the national development plan stipulates that by the year 2030 there needs to be a higher education system in place that enables graduates to achieve their full potential in higher education and training. Higher education must be available and accessible to all South Africans who wish to pursue such by the year 2030 (NDP, 2011).

The draft policy framework for the internationalisation of higher education in South Africa (2017), the NDP (2011) and the white paper for post-schooling education and training (2013) aims for the year 2030 to increase enrolment of postgraduate students by 25% at universities, to strengthen partnerships with industry role players, and to expand research capacity in South Africa. To make this vision a reality in South Africa, postgraduate education formats must be aligned with global formats by having work-integrated learning or workplace-based learning that will encourage those already employed to enrol in postgraduate programmes (NDP, 2011; DoE, 2017; DoE, 2013). This mode of postgraduate education could potentially internationalise postgraduate education in South Africa, making it accessible to all prospective students in the country and also putting it on par with the global trends (DoE, 2013).

2.6. Postgraduate education and research in orthotics and prosthetics

Orthotics and prosthetics are a relatively young profession both internationally and locally, with resultant lag in postgraduate education programmes (Hovorka, Shuur & Bozik, 2002b; Mduzana *et al*., 2020). In 2002, the United States of America only had one postgraduate Orthotics and Prosthetics programme at a master's level (Hovorka *et al*., 2002b). Anderson, Barnett & Rusaw (2020) has stated that ISPO will continue to play an active role by "providing a multidisciplinary platform for high quality evidence through publication of *Prosthetic and Orthotics International*".

Orthotics and prosthetics are a rapidly evolving profession. Due to changes in science and technology, the materials, equipment and assessment methods used are evolving fast. Wood and leather are replaced by lightweight alloys and plastics, computer technology is replacing physical assessment and manufacturing methods. These advancements are continuously developing and O&Ps need opportunities to advance their learning in these areas by keeping abreast with research on new developments in order to determine its application in their specific settings as well as with their individual patients (Lemaire *et al*., 2018; Ramstrand & Brodtkorb, 2008; Harkins *et al*., 2012; Taheri, Changiz & Tifighi, 2019a ; Spaulding, Kheng, Kapp & Harte, 2020; Boone, 2020).

For advancement in any profession to occur, the research foundation must expand and evolve. The future of the profession is dependent on its ability to add new knowledge through structured investigative processes (Hovorka *et al*., 2002b). 18 years ago, Hovorka *et al*. (2002b) stated that there was a lack of research in the field of orthotics and prosthetics. This lack was still evident in 2008 (Ramstrand & Brodtkorb, 2008). As recent as 2019, Magnusson (2019) identified a lack of evidence in prosthetics and orthotics in low and middle-income countries. The unavailability of postgraduate orthotics and prosthetics education programmes in Africa might contribute to insufficient research and evidence in the field and context that might negatively affect patient care and delay the advancement of the profession on the continent (Aduayom-Ahego, 2017).

Orthotists and Prosthetists should become more involved in research and not be reliant on other professions to contribute to the body of orthotic and prosthetic knowledge (Stevens, 2011; Ramstrand & Brodtkorb, 2008). There needs to be a cultural change in the profession and a change in the way Orthotists and Prosthetists perceive and utilise research in developing the profession. To facilitate this change, postgraduate education and research on clinical topics are required (Ramstrand & Brodtkorb, 2008).

Higher education (basic and postgraduate) in orthotics and prosthetics can assist the transition of orthotists/prosthetists from more technical staff to a member of the professional rehabilitation team (Taheri *et al*., 2019a; Ramstrand & Brodtkorb, 2008). It can further the development of the profession to be on par with other professions in the field of human rehabilitation services (Aduayom-Ahego & Ehara, 2016; Aduayom-Ahego, 2017; Hovorka *et al*., 2002b).

Currently, no African institution of higher learning offers O&P specific postgraduate programmes (Aduayom-Ahego *et al*., 2017; Mduzana *et al*., 2020). This leaves Africans who want to pursue profession specific O&P postgraduate education with only one option; to access programmes internationally. International study is more expensive than local study. It has other disadvantages like having to study in a foreign language and culture (Magnusson, 2019; Aduyom-Ahego & Ehara, 2016; Aduayom-Ahego, 2017; Mduzana *et al*., 2020). International programmes might not be appropriate to African requirements. Locally trained professionals might be better prepared to deal with local custom and clinical scenarios in Africa (Harkins *et al*., 2012; Aduayom-Ahego *et al*., 2017; Magnussion, 2019). It is thus not surprising that studies showed a need for Africa based postgraduate education programmes in orthotics and prosthetics (Magnusson 2019; Aduayom-Ahego *et al*., 2017).

2.7. Barriers to postgraduate orthotics and prosthetics education in Africa and South Africa

Establishing postgraduate orthotic and prosthetic programmes are challenged by barriers related to finances, equipment, material and staff (Aduayom-Ahego *et al*., 2017). Education programmes in orthotics and prosthetics are expensive to develop and maintain as expensive equipment and materials are required to provide optimal learning experiences (Hovorka *et al*., 2002b). A study from Togo shows a shortage of and outdated research equipment as barriers to orthotics and prosthetics postgraduate education as well to the facilitation of research development within the profession (Aduayom-Ahego *et al*., 2017). African students in orthotics and prosthetics often remain unexposed to the newest technology in orthotics and prosthetics during training, because the equipment and materials are not available at the teaching institutions and/or in the country (Aduayom-Ahego & Ehara, 2016). This hampers their learning opportunities and innovative evidence-based practice in orthotics and prosthetics (Aduayom-Ahego & Ehara, 2016; Horvorka *et al*., 2002).

The shortage in postgraduate education programmes results in a shortage of orthotists and prosthetists with the qualifications to act as educators in postgraduate programmes (Aduayom-Ahego & Ehara, 2016; Aduayom-Ahego, 2017). A need for improved qualifications amongst orthotics and prosthetics educators in Africa was specifically noted by participants in a study about graduates' perceptions of orthotic and prosthetic education and clinical practise in Tanzania and Malawi (Magnusson *et al*., 2016).

In addition to a lack of finances to run the programmes, prospective students are often plagued by a shortage of individual finances. They cannot afford to enter the education programmes without financial support (Magnusson, 2019; Aduayom-Ahego & Ehara, 2016)

2.8. Preferred modes of postgraduate education in orthotics and prosthetics

Orthotists and prosthetists prefer to have a choice of study options to choose from either part-time, online, distance or traditional education programmes. A variety of modes of learning encourage postgraduate education enrolment with a choice of best suitable individual option. These preferred modes make the postgraduate learning accessible to all who want to pursue the learning opportunity. The learning modes may also decrease the challenges caused by a shortage of finances and language barriers as postgraduate students may not need to travel afar nor study in a foreign language, but will be able to work whilst studying in their own environment and not incur extra costs (Dominquez & Gutiérrez, 2016; Smith, Boyd, Rogers & Le Jeune, 2016; Dlungwane, Voce, Searle & Stevens, 2017). The studies yield similar results in that they all found that there needed to be more postgraduate training of health services professionals, there needs to be more collaboration amongst learning institutions to strengthen staff capacity and more efficient investments, management and development and research development for postgraduate education in health services (Dominquez & Guitierrez, 2016; Smith *et al*., 2016; Dlungwane *et al*., 2017). Initiating collaboration with other universities internationally can serve as a base for knowledge exchange and transfer among orthotics and prosthetics educators for student capacity building. To allow easier accessibility of postgraduate education and research in orthotics and prosthetics across developing countries, an online mode of postgraduate education would be best suitable (Aduayom-Ahego & Ehara, 2016; Aduayom-Ahego, 2017).

2.9. Chapter summary

The United Nations and World Health Organization developed several policies and strategies to guide assistive technology services and education. WHO and the ISPO developed a set of standards and guidelines that include *recommendations* on education and training in orthotics and prosthetics. ISPO also provides accreditation for O&P training. In South Africa, orthotics and prosthetics training institutions offer full time qualifications up to a bachelor's degree. These programmes are accredited in South Africa. The South African accredited programme at TUT is in the process of obtaining international accreditation from the ISPO

Chapter 3

Methods

3.1. Introduction

Chapter 3 introduces the reader to the study methods. It starts with the research question, aim and objectives. It explains why a phased mixed method design was chosen. The selected population were South African Orthotists and Prosthetists registered with the Health Profession Council of South Africa. For phase 1 stratified random sampling was done per province. Phase 2 was a purposively selected sample based on the information participants provided in phase 1. Sampled individuals received an emailed information leaflet and consent forms (appendix A) and questionnaires (appendix B). Email reminders were sent every week for three weeks. A pilot study was conducted with three participants, who were excluded from the main study due to prior exposure. All data was recorded when received on an Excel spreadsheet and word document on a password-protected computer. Analysis and presentation of the quantitative data was done using IBM SPSS (Statistical Package for Social Science) program. For qualitative data a thematic analysis was formed.

3.2. Research question

Is postgraduate education available, important and accessible for Orthotists and Prosthetists in South Africa?

3.3. Aim

To explore the availability, importance, and accessibility of postgraduate education for Orthotists and Prosthetists in South Africa

3.4. Objectives

- Identify generic postgraduate education available for Orthotists and Prosthetists in South Africa
- Determine participant's opinion on the importance of postgraduate education for Orthotists and Prosthetists in South Africa
- To determine postgraduate education needs of Orthotists and Prosthetists in South Africa

- To identify the barriers to participating in postgraduate education by Orthotists and Prosthetists in South Africa
- To determine the format of postgraduate education preferred by Orthotists and Prosthetists in South Africa

3.5. Design

A mixed method approach that included the collection and analysis of both quantitative and qualitative data in a single study was followed. The mixed method approach permitted the provision of a holistic description on the topic on postgraduate orthotics and prosthetics education in South Africa, through data triangulating from diverse sources, data collection tools and data collection methods (O'Leary, 2017).

A sequential exploratory mixed method design with quantitative methods followed by qualitative methods as described by O`Leary (2017) was used. During the quantitative phase, information on available postgraduate education, the needs, the importance thereof, barriers to it and the preferred format of education was collected in a cross-sectional survey and through a desktop search of university websites. As shown in figure 3.1, this was followed by a qualitative phase where the quantitative responses were further explored to develop a more nuanced understanding of participants' opinion on postgraduate orthotics and prosthetics education in South Africa. Participant selection and interview schedule development for the second phase drew on findings from the first phase. Findings from the two phases were presented separately, then integrated during the discussion of the findings (O'Leary, 2017).

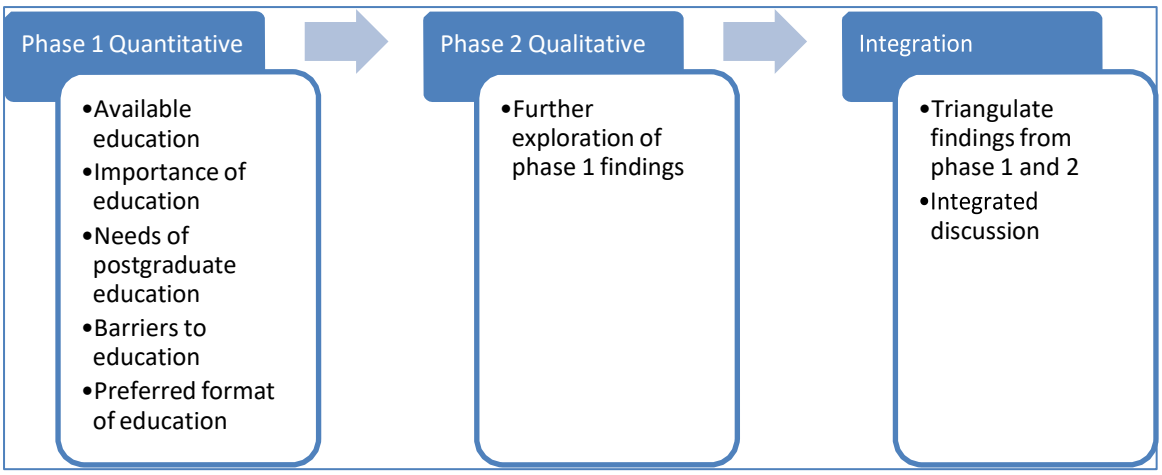

Figure 3. 1: Schematic presentation of the phased mixed method approach that was used in the study

3.6. Setting

The setting for the current study is South Africa. Orthotics and prosthetics services in South Africa are provided in the private or the public domain of the healthcare services. The majority of the country's population (83.1%) access public orthotics and prosthetics services (Statistic South Africa, 2018). Public orthotics and prosthetics services are provided at 22 centrally located government funded orthotics and prosthetics centres in more urban areas. Similarly, private services are also usually located in bigger towns and cities (Mduzana *et al*., 2020). According to Mduzana et al (2020) the current number of Orthotists and Prosthetists in South Africa is adequate for the size of the population.

3.7. Population, sampling & participants

A total of 519 Orthotists and Prosthetists were registered with the Health Profession Council of South Africa (HPCSA) in June 2019. These Orthotists and Prosthetists formed the study population. A complete list of names and contact details was obtained from the HPCSA.

Inclusion criteria

- O&Ps who were working at the time of data collection
- O&Ps that were practicing in SA

Exclusion criteria

- O&Ps that have retired
- O&Ps not working in the field of orthotics and prosthetics

3.7.1. Sampling

Phase 1

A sample of 260 was required for a population of 519 to achieve a 95% confidence level with a 5% confidence interval (50% response distribution) (Raosoft Sample size calculator, 2004). Stratified random sampling was done to select participants for phase 1 of the study. Stratification was done per province. Stratified random sampling was a preferred choice in heterogeneous populations as it minimises selection bias and ensures that the entire population group is represented. The researcher decided to sample half the number of Orthotists and Prosthetists from each province (see table 3.1). This provided a sample of 270 participants, 10 more than the

required number. The oversampling was meant to cover for the loss of participants due to not being able to trace people (undelivered emails), non-respondents, or people refusing consent. Participants were randomly selected employing the use of computer-generated numbers using calculator soup (Calculator Soup Online Calculators: Random Number Generation, 2016).

Table 3. 1: Number of O&Ps per province and number to be sampled

Province	EC	FS	GP	KZN	LP	MP	NW	NC	WC	Total
Total number	42	26	211	111	19	30	18	6	56	519
Nr to be sampled	22	14	107	57	11	16	10	4	30	270

Phase 2

Purposive sampling was used to identify eight participants for the second phase of the study. These participants were sampled based on information provided by them in phase 1. Participants were sampled in a purposeful manner from the 42 participants in phase 1 who stated their willingness to participate in a follow up interview. A heterogeneous group were sampled with participants differing in characteristics that might influence their view of postgraduate education (O'Leary, 2017). Participants differed with regards to their:

- Age
- Gender
- Province in which they practice
- Number of years in Orthotics and Prosthetics practice
- Type of qualification in Orthotics and Prosthetics
- Whether they saw postgraduate education as important or not
- Whether they prefer profession specific or generic postgraduate education
- Differing postgraduate education needs
- Different barriers to postgraduate education were also included (O'Leary, 2017)

3.7.2. Recruitment

Sampled individuals received an emailed information leaflet and consent form (Appendix A) detailing the title, aims and objectives of the study and their role in the study. The email also requested their participation in the study. Participation was entirely voluntary and participants were

free to decline and or withdraw participation from the study at any point, even after prior agreement to participate. One of the challenges of research via email is that participants can easily ignore the emailed questionnaire (O'Connor, Madge, Shawn & Wellens, 2011). To combat this, follow up reminders were sent out after one week (Appendix E). After a participant had received three email reminders with no responses, it was concluded that they do not want to participate (figure 3.2). Of the 270 sampled individuals, eight emails returned undelivered and four (2 pairs) had the same email address. Twenty percent (54) of the sampled individuals responded to the email. One said they had relocated out of the country and had to be excluded as per exclusion criteria. Another one had since left the profession and requested to be excluded. Five (2%) indicated that they were not willing to participate. Forty-seven (17%) completed the questionnaire and sent it back to me. For a detailed timeframe of the process see Appendix G. Forty-two (16%) of the participants indicated that they were willing to participate in a follow up interview.

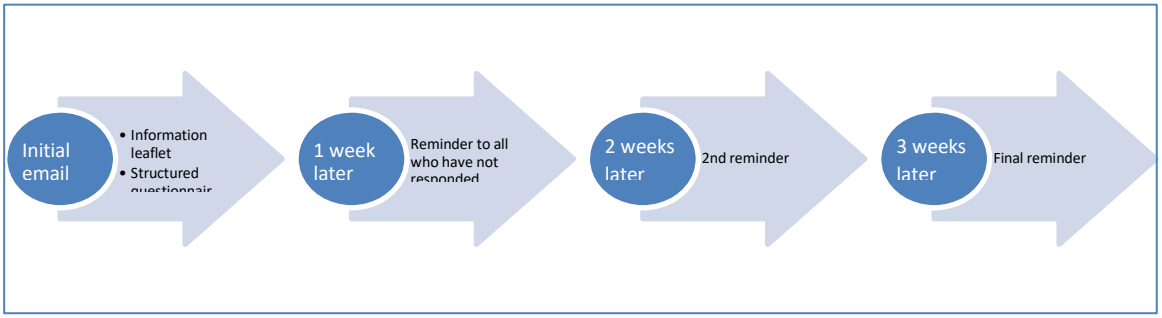

Figure 3. 2: Schematic presentation of recruitment process

3.7.3. Pilot

All data collection tools, and the information and consent leaflet were emailed as part of a pilot study to three randomly selected participants from the population group. These participants were excluded from the main study sample to avoid pre-exposure to the study, which can influence their responses. This pilot study is a critical part of a good study design since it pre-tests the research tools such as the questionnaire and semi-structured interview and check for content, word use, layout and clearness in addressing the study aims and objectives. It also checked the feasibility of the data collection process via email. The outcomes of the pilot study from the three participants, only one responded to phase 1 of the study and was willing to do a follow up interview and also was emailed phase 2 of the study, and responded and emailed back to me. Upon completion of the pilot study there were no changes made on any of the data collection tools.

3.8. Data collection tools and strategies

Table 3.2 provides an overview of the data collection strategies and how the different objectives were addressed through the varying data collection strategies.

Table 3.2: Overview of the data collection strategies

Objective	Type of data	Data source/s	Data collection tool	Data collection method
Availability of postgraduate education for O&Ps in South Africa	Quantitative	O&P practitioners Universities websites	Structured Questionnaire Word table	Email Online search
Determine participants opinion on the importance of postgraduate education for O&Ps in SA	Quantitative & Qualitative	O&P practitioners	Structured Questionnaire & Interview schedule	Email
To determine postgraduate education needs of O&Ps in SA	Quantitative & Qualitative	O&P practitioners	Structured Questionnaire & Interview schedule	Email
To identify barriers to participating in postgraduate education by O&P	Quantitative & Qualitative	O&P practitioners	Questionnaire & Interview schedule	Email
To determine the format of postgraduate education preferred by O&Ps in SA	Quantitative	O&P practitioners	Questionnaire	Email

Phase 1

Data from orthotists and prosthetists was collected via an email survey. The email data collection method was the most cost effective and allowed the researcher to collect data from a national sample of participants, which would not have been possible with personal interviews, due to distance, time and cost barriers (O`Connor *et al*., 2011). It also granted respondents the liberty to complete the questionnaire in their own time and environment (Bowling, 2005;

McCody & Kerson, 2006). The questionnaires were sent to participants via email and were returned via email (O'Leary, 2017; Peterson, 2000).

The questionnaire (Appendix B) was sent with the same email (Appendix D) as the information leaflet and consent form (Appendix A). The questionnaire (Appendix B) was developed by the researcher to address the research aim and objectives. It was sent for consultation to two industry experts for input. Completing and emailing the questionnaire back to the researcher confirmed that the participant agreed to be part of the study. The questionnaire was short to try to avoid participants dropping out of the study due to being overloaded with questions; it took 15-20 minutes to complete. The questionnaire could be completed in the Word document on computer or printed, completed and scanned and sent back via email (O'Connor *et al*., 2011). The data was collected in English as that is the language used for professional communication in South Africa.

Additionally, data on the availability of postgraduate programmes for orthotists and prosthetists (profession specific and generic) was collected from university websites. The sites of 14 purposively sampled universities were accessed. They included the ten highest-ranking public universities in South Africa (QS Top University World University Rankings, 2019. Available: https://www.topuniversities.com/university-rankings/world-university-rankings/). The leading online university in South Africa and the three universities that currently provide pre-graduate orthotics and prosthetics education were added to the list.

An online desktop search was conducted by the researcher and verified by one of the study supervisors. The search was limited to the Health Sciences or related faculties of these institutions. All data (name of the university, and name and level of the programme) was recorded in a Microsoft word table.

Phase 2

The semi structured open-ended interview schedule (Appendix C) was also sent as an email attachment (Appendix F) to participants. The questions were developed by the researcher and along with the cover email, sent out for consultation to two industry experts for feedback. Participants typed their responses and sent them back via email. The questions took 30-45 minutes to complete. The main questions that were asked in the semi-structured open-ended interview schedule to further explore the findings of phase 1 were as follows:

- You have indicated in the questionnaire that postgraduate education is (*add important or not important depending on the answer in the questionnaire*) to you. Could you please explain why this is the case?
- Why do you feel there is *(add sufficient or insufficient depending on the answer in the questionnaire)* profession specific postgraduate education opportunities for O&Ps in South Africa?
- Why do you feel there is (*add sufficient or insufficient depending on the answer in the questionnaire*) generic postgraduate education opportunities for O&Ps in South Africa?
- You have mentioned that (*add specific barrier*) makes it difficult for you to engage in postgraduate education. Could you please tell me more about that?
- Why would you prefer (*add on line, distance or traditional programmes depending on the answer in the questionnaire*) postgraduate O&P education?
- In your opinion why is it important to offer (*add discipline specific or generic depending on the answer in the questionnaire*) postgraduate education programmes for O&Ps in South Africa?
- If you have explored or participated in postgraduate programmes previously could you please tell me about the experience?
- Any other comments you wish to share?

3.9. Data Analysis

Quantitative data

All phase 1 data was captured as it was received on an Excel spread sheet and stored in rows that were labelled with participant codes and columns with a brief one-word title used in the analysis as a variable to be referred to. Each column dealt with one variable containing numbers i.e. 1 for male and 2 for female, where no data blank spaces appeared. In data sets where there were multiple possible responses, each option was treated as a separate column in the spreadsheet. Once all the information was entered, it was checked and cleaned using a filter tool in Excel to recognise any mistakes when entering the data (Mash & Ogunbanjo, 2014).

This finalised raw data was exported to IBM SPSS (Statistical Package for Social Science) software program for data analysis and presentation of the results. The software program is user friendly as it can perform highly complex data manipulation and analysis with simple instructions (IBM Corp., 2017. IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp.

Available: https://www.ibm.com/analytics/spss-statistics-software). A Multivariate data analysis will be used to compare and make inferences about any statistical significance (Mash & Ogunbanjo, 2014; O'Leary, 2017).

Categorical data will be presented as frequencies and percentages in which results will be presented in table and or graphical (histogram) form. Continuous data if normally distributed or skewed can be analysed as a mean with a range, and standard deviation. The standard deviation indicates the data spread of the total data set where a small standard deviation implies the data is more closely dispersed around the mean. The 95% confidence interval indicates that the real mean of the population is likely to fall between the upper and lower limits of the interval. This data will be presented in a table 3 (Mash & Ogunbanjo, 2014; O'Leary, 2017). Aims to compare the outcomes with the various comparators in the questionnaire noting that both the outcomes and comparator are categorical data, the data types compared are categorical against categorical data. The data sets are compared in a contingency 2 by 2 table using a chi-square test with a measure of occurrences as a *p*-value set as less than 0.05 (less than 5%) noted as statistically significant (Mash & Ogunbanjo, 2014; O'Leary, 2017).

Qualitative data analysis

Data was collected via email in word format. Thus, no transcription was needed before analysis could start. During the data management process, I read carefully through the answers of participants to determine if I would like to further explore some issues. All the participant responses were clear. No one was contacted for further explanation.

Thematic analysis was done to identify emerging themes from the data. An interactive six-step approach as explained by Braun and Clarke (2006) was followed:

- Initially I looked for and wrote down patterns and interesting issues in the data by reading through it thoroughly more than once.
- Initial codes, "a feature of the data that appears interesting" (p 18) was developed from the data.
- Sorted and combined different codes into a number of overall themes.
- Review and refine themes through combining some themes, splitting other into more than one theme or even illuminating some due to insufficient supportive data.
- Define and name themes.

- The findings and themes are reported (O'Leary, 2017; Bruan & Clarke, 2006).

3.10. Rigour

Phase 1

The online survey has been sent to experts in O&P research for their input and to enhance content validity (Mokkink, Terwee, Patrick, Alonso & Stratford, 2010). However, it has not been tested for criterion validity and reliability.

Phase 2

Credibility. Findings from the quantitative (phase 1) was triangulated with the findings of qualitative (phase 2) to provide a holistic understanding of the study aim and objectives. Purposive sampling should further enhance credibility (Mabuza, Govender, Ogunbanjo, & Mash, 2014). Triangulating the findings deepened the collected data sets using a two-phased mixed method approach on the same topic by putting together various opinions to provide a much stronger holistic report rather than just accepting a one-sided viewpoint (Barusch,, Gringeri & George, 2011).

Transferability. The second phase drew on the findings of phase 1 whereby participants were purposively selected to complete a semi-structured interview with the aim of further exploring and developing the findings of phase 1. The study methods were described in detail (Mabuza *et al*., 2014).

Dependability. In an integrated discussion on the findings from phase 1 and 2 were triangulated and presented along with the discussion of any limitations in the study. The research methods used were described (Mabuza *et al*., 2014).

Confirmability. Triangulation of the findings of phase 1 and 2 and reflexivity was used to ensure conformability. The reporting was based on the data and not my characteristics and predilections of the research.

As a research instrument, I might have influenced the study due to the nature of the profession of orthotics and prosthetics, which is quite small within South Africa, and some participants may have known me personally. There is a likelihood that selected participants may have engaged with me on some level whether as a student in Orthotist and Prosthetist or on a professional basis, this means that they may have a one-sided view and may not be open-

minded when responding to the questionnaire. I might have influenced the study due to engagement or interactions with the population group during the time of the data collection as participants may have responded with their current sentiments to the research project and not from a neutral point of view based on their affection towards the researcher at the time (Mabuza *et al*., 2014).

Reflection. I have not introduced bias during data collection as the data was not collected by face-to-face interview. However, I did have an influence on data as I developed the data collection tools. I wish to state that I am currently an employee at the Tshwane University of Technology (TUT), as a junior lecturer Medical Orthotics and Prosthetics holding a Postgraduate certificate in rehabilitation studies (PGCert Rehab Studies) from the University of Strathclyde in Scotland and a Bachelor of Technology (Btech) and National Diploma (NDip) in Medical Orthotics and Prosthetics from Tshwane University of Technology in South Africa. I sought postgraduate studies through distance learning internationally which was very costly but due to lack of support, insufficient training and development in orthotics and prosthetics in South Africa, I graduated with a postgraduate certificate in rehabilitation studies in 2016. I sought to pursue related postgraduate studies in South Africa in 2017, registered for the Masters in Human rehabilitation Studies at Stellenbosch. It should be noted that this is a requirement for my work contractual obligation, whereby I have to obtain a Master's degree within a 5-year period to get permanently employed and parallel development within TUT structures. The chosen research topic was based on my engagement and participation at various association levels. As a member of the South African Orthotics and Prosthetics Association (SAOPA), Association of Prosthetics and Orthotics Southern African Development Community region (APOSADC), and the International Prosthetics and Orthotics Society (ISPO), similarly educational discussions tend to trend along the existing or lack thereof of orthotics and prosthetics postgraduate education, training and development opportunities for Orthotists and Prosthetists. This has sparked my interest in researching the availability, importance and accessibility of postgraduate education for Orthotists and Prosthetists in South Africa.

3.11. Ethical Considerations

Ethical clearance was obtained from Stellenbosch University's Health Research Ethics Committee (HREC), ethics reference #: S19/01/001.

Beneficence non-maleficence. I was responsible for ensuring that participants did not come to physical or psychological harm (Eynon, Fry & Schroeder, 2011, 2011; DoH, 2015). There were no physical risks involved in participating in the study. The risk for psychological harm was also very low as the information sought was not of a sensitive nature. Since data was not collected face to face, I had no way of determining if participants experienced emotional discomfort. However, in the unlikely event of this happening they could have left the study by just not further completing the questionnaire (Eynon *et al*., 2011).

All information was stored on a password-protected laptop and hard drive; emails were deleted from the inbox to ensure no potential leakage of participant information. However, having used emails to collect data, unfortunately there may have been some compromise of anonymity of participants. It may have been possible to identify participants from their email addresses as these often contain names and or surnames and corporate affiliations. Copies of emails are also retained at servers (Eynon *et al*., 2011). Since the data collected in the current study was not of a sensitive nature it was decided that even with these challenges email can still be used for the data collection. Data was accessible to me, my supervisor and statistician. No names of participants were used in reporting the findings (Eynon *et al*., 2011).

Dignity and autonomy. Participants did receive an information leaflet and consent form for online surveys/questionnaires (Appendix A) via email at the same time as the first questionnaire (Appendix B). This leaflet provided information about the study purpose, the role of participants as well as possible harm and benefits for participants. This leaflet also stated that completing and returning the questionnaire shows that participants gave consent to be part of the study. I could be contacted via email or phone if participants had any further questions. Participants were free to decline to participate or to stop completing the questionnaire at any time, even if they had already agreed to take part initially. All participants were professional Orthotists and Prosthetists currently practicing in South African and were mentally capable to provide informed consent.

Distributive justice. All HPCSA registered O&Ps formed the study population. Participants were selected randomly using computer-generated numbers with no discrimination against anybody (DoH, 2015).

3.12. Limitations

As mentioned earlier the survey instrument was not tested for validity and reliability.

Even with three follow up email reminders the response rate in the qualitative part of the study was very low. This was anticipated to an extent as it is one of the challenges for data collection via email surveys (Sue & Ritter, 2011). Since demographic information was not available for non-responders, it was not possible to compare the two groups for differences and similarities. One might however surmise that those who did respond might be more interested in the topic than those who did not respond (Sue & Ritter, 2011). The low response rate from the quantitative study (17%) in phase 1 meant that findings cannot be generalised to all Orthotists & Prosthetists in South Africa.

Orthotics and Prosthetics remain a relatively small profession within South Africa, so participants may have chosen not to respond because they do not like me, or participants may have felt obligated to respond because they know me personally. Participants may have felt the need to lie for fear of being judged for their responses. Participants lacking knowledge in postgraduate orthotics and prosthetics education in South Africa may have answered questions that they have no or limited knowledge on. To offset this information on one aspect, which could be verified from a different source, i.e. available postgraduate programmes were also sourced from university websites. The findings should be read and interpreted against these limitations.

3.13. Chapter Summary

A phased mixed method design was used. The setting of the study was South Africa and the population was all HPCSA registered Orthotists and Prosthetists practicing in South Africa. Random and purposive sampling was done for phase 1 and 2 respectively. Data was collected for both phases (quantitative and qualitative) via email, recorded on a Microsoft excel spreadsheet and saved on a password-protected computer. Analysis of the data was done using IBM SPSS (Statistical Package for Social Science) program for phase 1 quantitative, and for phase 2 qualitative data an inductive thematic analysis was done by hand. Ethical principles were adhered to during the study.

Chapter 4

Quantitative Findings

4.1. Introduction

The results presented here include the participants` demographic, O&P education and employment details. It also presents the findings on postgraduate education availability, importance, needs and barriers. Findings on the role of gender, age, number of years in orthotics and prosthetics practice, and employment status in the perceived importance of postgraduate education in South Africa is also presented.

4.2. Demographic, orthotic, and prosthetic education, and employment details

A total of 47 (17%) of the sampled participants completed the questionnaire and sent it back via email. Table 4.1 shows the response rates per province. Gauteng had the highest response rate at thirty-four percent, followed by the Western Cape at seventeen percent and KwaZulu Natal at thirteen percent with no responses coming back from the Northern Cape.

Table 4. 1: Number of O&Ps in population, in sample, and responders per province

Province	EC	FS	GP	KZN	LP	MP	NW	NC	WC	Total
Total number	42	26	211	111	19	30	18	6	56	519
No. sampled	22	14	107	57	11	16	10	4	30	270
No. of responses	5	2	16	6	2	5	3	0	8	47

Slightly more males (27, 57.4%) participated in the study than females (20, 42.6%). As shown in table 4.2 the mean age of participants was 34 (sd 9.71).

Table 4. 2: Age distribution of participants (N=47)

Mean	34.0213
Std. Deviation	9.71214
Range	33.00
Minimum	22.00
Maximum	55.00

Table 4.3 shows that participants had been qualified in orthotics and prosthetics for a mean of 11 years (sd 9.56). The least amount of time qualified in orthotics and prosthetics practice was

2 years with a frequency of six. The greatest number of years in orthotics and prosthetics practice was 32 years with a frequency of two.

Table 4. 3: Years in Orthotics and Prosthetics practice distribution (N=40)

Mean	11.3000
Std. Deviation	9.56275
Range	30.00
Minimum	2.00
Maximum	32.00

Most participants held either a National Diploma (19; 40.2%) or a Bachelor of Technology degree (21; 44.9%) qualification. The Bachelor of Technology degree is a skills-based qualification and obtained from a university of technology after graduating with a National Diploma. The degree qualification, held by seven (14.9%) participants, is knowledge orientated and obtained over a four year study programme. Five (10,6%) participants had generic postgraduate qualifications which included postgraduate certificates and diplomas and master's degrees. One participant was currently enrolled for a generic master's qualification. No participant had a Doctorate qualification.

The government employed the majority of the participants (19; 40.2%). Private sector employed a further twelve (25.5%), eleven (23.4%) were self-employed, and five (10.6%) were employed by teaching institutions.

4.3. Postgraduate education availability, importance, needs and barriers

Data gathered from the websites of 14 South African universities showed that there was no profession specific postgraduate programmes offered for orthotists and prosthetists at these universities. It further shows that generic postgraduate diploma, masters and doctoral programmes were available as summarised in table 4.4. Programmes in health services/systems (9), health science education (11) and public health (19) were most common.

Table 4. 4: Postgraduate programmes offered by South African Universities Health Science faculties that O&Ps can enrol in

Programme	UCT	WITS	US	UJ	UP	KZN	NWU	UWC	RU	UFS	TUT	WSU	DUT	UNISA
Postgraduate diploma														
Disability / Rehabilitation	X		X											
Health systems/service management	X	X	X		X				X				X	
Health economics	X													
Health science education	X	X								X				
Health research ethics			X											
Public Health	X	X			X	X		X						X
Masters														
Health ethics			X											
Health sciences	X	X	X	X	X									
Health systems	X		X											
Human rehabilitation			X											
Public health	X	X		X	X	X		X						X
Health economics	X													
Health Science Education		X	X				X			X				
Doctoral														
Health sciences		X	X	X										
Health systems					X									
Rehabilitation			X											

Public health	X	X			X	X		X						X
Health Science education		X	X				X			X				
Health Ethics					X									
None											X	X		

According to participants, profession specific postgraduate education programmes for Orthotists and Prosthetists was not at all/a little (44, 93.6%) sufficient in South Africa. Furthermore, 34 (72.3%) participants indicated that there were not at all/a little sufficient generic postgraduate education programmes for Orthotists and Prosthetists in SA (Table 4.5).

Table 4.5 shows that 41 (87.2%) participants thought postgraduate education was quite/extremely important. Twenty-one (44.9%) participants said they had specific postgraduate education needs. Those with needs indicate either profession specific programmes (10; 21.3%) or generic programmes (11; 23.4%).

Table 4.5: Summary of scores on importance of, sufficient profession specific and generic postgraduate education programmes in SA (N=47)

		Frequency	Percent
Importance of postgraduate education	Not at all	0	0
	A little	6	12.8
	Quite	15	31.9
	Extremely	26	55.3
	Total	47	100.0
Sufficient profession specific postgraduate education programmes	Not at all	22	46.8
	A little	22	46.8
	Quite	0	0
	Extremely	1	2.1
	Do not know	2	4.3
	Total	47	100.0
Sufficient generic postgraduate education programmes	Not at all	7	14.9
	A little	27	57.4
	Quite	7	14.9
	Extremely	2	4.3
	Do not know	4	8.5
	Total	47	100.0

The type of postgraduate education preferred was selected as discipline specific education (39; 83.0%). The preferred that a programme be a structured masters with course work (27; 57.4%). Participants preferred postgraduate programmes presentation (Table 4.6) in web based/online format (31; 66%).

Table 4.6: Type of postgraduate programmes required by participants and preferred mode of delivery of programmes

		Frequency	Percentage
Type of postgraduate education (N=47)	Discipline specific	39 (83.0%)	83.0%
	Generic	4 (8.5%)	8.5%
	Combined	4 (8.5%)	8.5%
***Type of programmes**	Postgraduate diploma	6 (12.7%)	12.7%
	Structured masters with course work	27 (57.4%)	57.4%
	Masters by dissertation	20 (42.6%)	42.6%
	PhD	18 (38.3%)	38.3%
Mode of presentation of programmes (N=46)	Web based/online distance or local	31 (66.0%)	66.0%
	Traditional programmes offered at learning institutions	6 (12.8%%)	12.8%
	Web based and traditional	8 (17.0%)	17.0%
	Web based/online with contact sessions	1 (2.1%)	2.1%

*Some participants selected multiple options

Barriers to engaging in postgraduate education is shown in (Table 4.7). Cost, time, funding, distance and no available postgraduate programmes (19; 40.4%) were the most common barriers. Four (8.5%) participants had missing information and left a blank space in the questionnaire.

Table 4.7: Barriers to engage in postgraduate education (N=43)

Barriers	Frequency	Percent
Cost, time, funding, distance and no available postgraduate programmes	19	40.4
Unavailability of suitable programmes for Orthotists and Prosthetists	12	25.5
Lack of motivation, incentive and interest	10	21.3
No barriers	2	4.3

4.4. Role of demographic variables in importance of postgraduate education

The aim was to test the role of the demographic variables on the perceived importance of postgraduate education in South Africa. The data set was subjected to a chi-square test with a measure of occurrence as a *p*-value set at less than 0.05 and noted as statistically significant. The gender ($p \leq 824$) was statistically insignificant when tested with the importance of postgraduate education for Orthotists and Prosthetists. Age ($p \geq 0.317$), number of years in orthotics and prosthetics practice ($p \geq 0.453$) and employment status ($p \geq 0.752$) also did not have a significant statistical impact when compared to the importance of postgraduate education for participants.

4.5. Chapter Summary

Slightly more males than females participated in the study. Ages were distributed evenly ranging from 22 to 55 years (mean 34). Participants qualified in orthotics and prosthetics were between two and 32 years with a mean of 11.3 years ago. Eighty-seven-point two percent (41) indicated that postgraduate education was quite/extremely important. They agreed that there was not at all/little (44, 93.6%) profession specific postgraduate education programmes for Orthotists and Prosthetists in South Africa, while (34; 72.3%) felt that availability of generic postgraduate education options was quite/extremely sufficient in South Africa. Twenty-one (44.9%) had postgraduate education needs. Cost, time, funding, distance and no availability of postgraduate programmes (19; 40.4%) stood out as the leading barriers to engaging in postgraduate education. The preferred presentation of programmes was web based/online learning (12; 25.5%) in orthotics and prosthetics discipline specific education (39; 83%), presented in a structured masters with course work (11; 23.4%) format. Demographic variables did not have significant statistical impact on the importance of postgraduate education in South Africa.

Chapter 5

Qualitative findings

5.1. Introduction

This chapter presents the qualitative findings. It commences with the demographic details of the participants of phase 2. Emerging themes supported by narrative examples are presented next.

5.2. Demographic details of participants in the qualitative phase

The male participants (5, 60%) continued to dominate in phase 2. The overall ages of participants varied between 24 to 49 years (Table 5.1). The participants number of years in O&P practice ranged from being less than 5 years to over 20 years in practice. Most participants were in possession of a Btech qualification (6; 75%) as shown in table 5.1.

Table 5.1: Demographic details of participants in the qualitative phase

Participant nr	Age	Gender	Province	Years working as O&P	Highest qualification	Employment sector
003	35	M	MP	5 years	Btech	Government Employed
005	24	F	WC	2,5 years	Btech	Self Employed
014	49	F	L	13 years	Btech	Self Employed
019	36	F	MP	14 years	Btech	Government Employed
022	29	M	KZN	5 years	NDip	Government Employed
033	39	M	KZN	20 years	NDip	Government Employed
038	35	M	EC	7 years	Btech	Government Employed
029	48	M	GP	28 years	Btech	Employed in teaching institution

5.3. Emerging themes

A thematic analysis was done that identified emerging themes from the data in an interactive step-by-step approach and the following 4 themes were derived:

Theme 1: Advancement of the profession

Theme 2: Personal growth

Theme 3: The future of postgraduate orthotics and prosthetics education in SA

Theme 4: Barriers to pursuing postgraduate education

5.3.1. Theme 1: Advancement of the profession

The theme of advancement of the profession could be pulled like a golden thread through answers to several questions and through the responses of multiple participants. Participants felt the orthotics and prosthetics profession needed to develop and be elevated to a higher position, because it was not given the respect and recognition it deserved in the health care environment. They stated that postgraduate programmes (generic and profession specific) could assist the orthotic and prosthetic profession to grow in stature and to take its rightful place amongst health care professionals in South Africa as well as Orthotists and Prosthetists professionals globally.

According to participants O&Ps were perceived to be of lesser importance than other health care professions.

> "[…] Orthotists and Prosthetists in SA is not taken seriously in my opinion." (005)

Some participants linked this ascribed lesser stature to the practical nature of the profession.

> "[…] it was seen as a hands-on profession; the mentality was that we were a production facility in most South African Orthopaedic Institutions. The Rehabilitation teams did not take Orthotist and Prosthetist seriously until the profession underwent scrutiny in 2010." (033)

Other participants linked the lack of recognition of the profession to a shortage of postgraduate education.

> "Orthotics and prosthetic professional tend to be looked at by other rehabilitation team members to have less knowledge which might be because of their level of education." (003)

Thus, they argued that postgraduate education and the scientific evidence associated with it can facilitate development and growth in the profession.

> "It [postgraduate education] is very important for the growth and progression of the whole profession. Research will ensure that us Medical Orthotists and Prosthetists are seen as equals in our medical team. Research and publications are the only way to advance any speciality field." (029)

They further implied that their South African qualification was not on par with international standards and again saw postgraduate education as the remedy.

> "It [postgraduate education] should be offered so that we can be on par with world standards, ISPO etc." (033)

> "[…] postgraduate programme discipline specific for profession Orthotics and Prosthetics in South Africa will help South African Orthotists and Prosthetists practitioner to be internationally recognised and accredited." (014)

5.3.2. Theme 2: Personal growth

In addition to advancing the profession, participants felt that postgraduate education programmes will assist with personal growth and development. Attaining a postgraduate qualification is an individual pursuit and will, therefore, first of all benefit the person who attained the qualification.

> "[I am] currently busy with the masters in human rehab at the Tygerberg campus. It has been an amazing experience so far and has allowed personal and professional growth. I would recommend it to anyone." (005)

Participants also felt that by bettering themselves they will improve the service they deliver to patients.

> "For advancement and improvement of treatment, healthcare and management of orthotics and prosthetics practice." (003)

Currently, in South Africa, gaining knowledge and acquiring a higher qualification holds no monetary advantage to Orthotists and Prosthetists as the studies are costly and time consuming with little prospect of it being recognised through an increase in salary/income.

> "[…] it's going to take up so much time and funds, and only the knowledge may benefit me, since I will get no recognition for it, in terms of better remuneration etc." (019)

Therefore, it seems as if the motivation to enrol in further studies mostly comes from a personal drive to succeed with little outside incentive:

> "Postgraduate [education] is extremely important especially if it is related to the field that one is working in, if one is career driven and wants to excel and go overseas, postgraduate studies are important. If one is to conduct seminars, lectures and do presentations on materials and subjects related to orthotics and prosthetics." (033)

5.3.3. Theme 3: The future of postgraduate orthotics and prosthetics education in SA

Participants also wrote about their hopes for orthotics and prosthetics postgraduate education in South Africa in times to come. As with most other fields, the orthotics and prosthetics field has much more to offer than what can be covered at pre-graduate level. Therefore, according to them it is essential that orthotics and prosthetics postgraduate education be enhanced in future.

> "[…] it is such an amazing and respectable profession with a lot to learn. I don't feel we can learn enough in undergraduate studies […] When you commit to going into a profession, there is always more to learn. One should not stop studying because you have received your degree. It is important to keep studying and keep learning, keeping up with what is happening within the industry and learning what is new. We do not and never will have all the knowledge. It is our responsibility to keep bettering ourselves through education." (005)

Participants felt that both profession specific and generic programs had a role to play.

> "Specific, because there is none. Generic, since it is applicable and already developed." (019)

It was important to them that the institutions currently offering pre-graduate programmes expand their programmes to include orthotics and prosthetics specific postgraduate programmes as well.

> "We need our own Masters and doctoral programmes in SA. These programmes need to be more MOP specific. Structured programmes are needed more than pure research masters due to our limited knowledge of research. The BTech was not really enough of an introduction to research to jump straight into a full research masters. I would prefer if TUT's Masters programme was developed and we had staff capacity to ensure a steady stream of masters and eventually doctoral students. The Masters in Health Sciences with an MOP focus is the ideal way to go for us here in SA. Maybe DUT and WSU could start similar programmes if they don't already have." (029)

Generic programs must welcome Orthotists and Prosthetists through including the profession in the training material and making sure that practical examples, case studies, course work, and assignments are structured in ways that made Orthotists and Prosthetists feel welcome and allow them to contribute to the learning experience of all through drawing from their profession.

> "I have tried UNISA in a master's in public health structured course but it was not really a passion and only loosely tied to MOP. The supervisor did not really understand our profession." (029).

Participants felt generic programmes can help Orthotists and Prosthetists to enhance their role in health care service delivery in SA.

> "[I]t is important to offer generic postgraduate education programmes for O&P so as to widen its scope and involvement within the current health system in SA." (038)

They differed on whether there were sufficient generic programmes available in SA.

> "There are insufficient generic postgraduate education opportunities." (038)

> "Sufficient, since MOP are often part of an MDT approach for rehabilitation, a lot of allied study fields are very related and appropriate knowledge to apply within the field of MOP, people feel that the knowledge gain by an Allied health program of study, aids their ability and knowledge to do their job better. I believe that and do many "generic" CPD courses, since it forms a background to my patient's diagnosis, or help me to better my function in the MDT to aid optimal rehabilitation for the patient." (019)

Participants envisioned part-time, online, distance and traditional education programmes. The variety of platforms will ensure higher accessibility while still catering for the needs of individual students and the learning requirements of specific subjects. Online, distance learning was seen as time and money saving since travel and accommodation does not have to be factored into the cost. It also fitted more seamlessly into work and personal life as less time is spend away from home and the hours spend learning can be negotiated to suit each individual's lifestyle and requirements.

> "Online, so it`s easily accessible in any part of South Africa and may even be cheaper, traveling and accommodation not needed." (019)

Another suggestion propagated online programmes supported by strategic contact sessions.

> "I think a combination between online and traditional is needed. Having a contact session in the beginning helped me to understand what was going on online. It was helpful to meet the lecturers, supervisors. The online platform is needed because not everyone lives in Cape Town and usually if you are at postgraduate level, you can come to class for a contact session but not go to class full time. Work and time during the day is a factor to be considered." (005)

The need for traditional programs in a profession that is essentially built on skills was not ignored.

> "I would prefer both distance and traditional programme depending on the level of study. For practical exposure I would prefer traditional programmes while for postgraduate research related studies I would prefer distance learning." (038)

5.3.4. Theme 4: Barriers to pursuing postgraduate education

Participants agreed that cost, and time pressures hampered pursuing postgraduate education.

> "[…] there is lack of funding for postgraduate studies […] lack of sponsorships. With the financial responsibilities that I have, I cannot afford to pay for my own postgraduate education." (022)

> "I have a family and full-time occupation, to find time in between to study is difficult-study leave also not easily granted, and to use annual leave is to not have leave when you need it […] funds are not always available, and for now it is seen as a luxury to have funds for further study." (019)

On top of cost and time pressures, a shortage of suitable programmes was mentioned. There are no orthotic and prosthetic specific programmes and few relevant generic postgraduate programmes in South Africa. Those who accessed orthotics and prosthetics specific programmes overseas found it stressful and not sustainable.

> "There are no specific MOP Masters programmes in SA. Strathclyde and Australia are very expensive and beyond the reach of ordinary people." (029)

> "I have tried to do a post grad certificate with the University of Strathclyde. The distance firstly was a challenge. Communication was difficult. [I] could never have physical contact with my mentor. Everything was through e-mails which sometimes take a lot of time to get a response." (022)

Some participants argued that a dearth of internal motivation and external incentives added to insufficient interest in postgraduate programmes amongst Orthotists and Prosthetists.

> "[…] maybe no one (at first) felt the need to have a higher education, their graduation serves them with the knowledge to do their job/ passion, no more studies needed, why would you then spend time and money? Also, if it was never recognised to be such an "educated" profession, rather a practical one, why would anyone bother of getting things together to improve, knowledge of an already graduated MOP." (019)

> "[…] lack of motivation for people to study further due to job opportunities […] with the economy companies cannot afford to employ overqualified people or rather people with post grads permanently due to managing costs." (022)

5.4. Chapter Summary

All the themes that emerged were presented and the findings were quoted directly from the participant responses on the emailed word document.

Participants expressed that generic and profession specific postgraduate programmes could assist the stature of the O&P profession and help orthotics and prosthetics take its rightful place amongst health care professions in South Africa and globally amongst O&P professionals. They also viewed postgraduate education as a solution to elevate the South African O&P qualification to be on par with the international standards.

Participants saw postgraduate education programmes as a means of personal growth and that it would assist them as individuals to improve on their service delivery to patients. Postgraduate education in the O&P profession hold no monetary advantages or other incentives for postgraduate studies in South Africa. Self-motivation and the need to succeed are strong incentives to pursue postgraduate education. Participants hoped that in future the O&P profession in South Africa would further enhance postgraduate education programmes. It was viewed as important for the current institutions offering pre-graduate programmes in O&P to expand their programmes and include O&P specific postgraduate programmes. Although the role of generic programmes was acknowledged, it was also noted that it is of importance that these programmes accommodate O&Ps by drawing on examples and experience from the orthotics and prosthetics profession. Preferred postgraduate education was envisioned through various platforms to cater for the different learning styles of participants and to also make it available and accessible to all who wish to pursue such. Barriers to pursuing postgraduate education in orthotics and prosthetics in South Africa were cost and time pressures. Although the participants also mentioned that there was a shortage of suitable programmes (like no O&P), specific and limited relevant generic postgraduate programmes are available in South Africa.

Chapter 6

Discussion of the findings

6.1. Discussion of the findings

South Africa has a population of 56,5 million; 51% are women whilst only 44% of South African women have professional employment (Statistics South Africa, 2018. Available: http://www.statssa.gov.za/?m=2018). In this study, more males (57.4%) than females (42.6%) participated, which might be an indication that, in Orthotics and Prosthetics, women are not represented equally, continuing the general trend of less women than men in professional employment in South Africa. However, internationally and locally orthotics and prosthetics is a male dominated profession, which has seen a steady increase in females over the years, but not to the point where the number of women in the profession is equal to the number of men (Mduzana *et al*., 2020).

Five (10.6%) participants held postgraduate qualifications. Generic postgraduate programmes in South Africa such as the Master of Public Health and the Master and Doctorate in Human Rehabilitation Studies accommodate students from multiple health and social science disciplines (Dlungwane *et al*., 2017). Participants shared in the qualitative interviews that there is currently no monetary gain or other recognition for O&Ps who obtain postgraduate qualifications. The barriers of cost, time, and a shortage of programmes coupled with decreased internal and external motivation seemingly culminated in little interest amongst South African O&Ps to pursue postgraduate studies, even though they see it as important. The Master of Public Health is widely recognised as a postgraduate qualification for leadership positions in health care services (Dlungwane *et al*., 2017). Therefore, it might be a programme that could assist O&Ps to increase the footprint of their profession in the South African health care environment.

Usually, postgraduate education promotes employment opportunities (Dominguez & Gutiérrez, 2016; Smith *et al*., 2016). Professionals that have or were engaged in postgraduate studies often found suitable employment while they were still in the process of completing their studies. Employment opportunities are not just based on technical skills and knowledge but also on the ability to build interpersonal relationships, communication, and cultural and strategic thinking skills. Participation in research, enhanced understanding, noting information from a variety of people, and utilising a multitude of resources in the process of fact finding and report

writing, are skills that postgraduate education develops (Dominguez & Gutiérrez, 2016). These skills can enhance critical work skills.

Participants felt that postgraduate education is important for O&Ps in South Africa for personal growth. These findings were in accordance with that of Smith *et al.* (2016) where a group of American dental hygienists indicated that postgraduate education could enhance personal development.

In accordance with Lapkin, Levettt-Jones & Gilligan (2011) and Smith *et al.* (2016), participants maintained that postgraduate education, research, and scientific evidence from postgraduate programmes could lead to advancement of the profession. Participants conveyed the need to be given respect and recognition within the health care environment. Postgraduate education was seen as a tool that can raise the stature of the orthotics and prosthetics profession (Hovorka *et al*., 2002b; Ramstrand & Brodtkorb, 2008; Taheri, Changiz & Tifighi 2019b; Magnusson, 2019).

An efficient contemporary approach to the advancement of orthotics and prosthetics education programs would also promote an orthotics and prosthetics profession that is better equipped for their inclusive role in the rehabilitation team (Boone, 2020). The role of O&Ps has shifted from a focus on the technical aspects of device designing and manufacturing, to becoming a professional member of the therapeutic team (Taheri *et al*., 2019b; Brooke, 2020). According to Hovorka (2002b), master`s programs can enhance the development of the orthotics and prosthetics profession and develop O&Ps into leaders in health care, education, research and administration. A recent African study by Magnusson (2019) showed that O&Ps expressed that there still exists low awareness and prioritising of orthotic and prosthetic services and that O&Ps have a low profile within the rehabilitation team.

Many vital concepts in orthotics and prosthetics are founded on generalisations and clinical expertise that have not been proven through scientific research. Therefore, ongoing research is important to establish evidence that can support orthotics and prosthetics services (Bolier, Haverman, Kramer, Westerhof, Riper, Walburg, Boon & Bohlmeijer, 2013. Ramstrand and Brodtkorb (2008) argue that evidence from research can justify the cost of assistive device interventions, and assist in choosing between specific components e.g. knee joints, and show interventions are efficient. It is also important for the prosthetics and orthotics profession to

consider the EBP practices of its professional peers. Other members of the rehabilitation team, such as physiotherapists and occupational therapists, are developing EBP (Cullen & Titler, 2004). Our colleagues in the rehabilitation team will then expect O&Ps to similarly practice from an EBP platform.

Postgraduate education and the research work that is often associated with it could improve evidence based clinical services, enhance knowledge, and contribute to the body of research in the field of orthotics and prosthetics in South Africa and Africa (Ramstrand & Brodtkorb, 2008; Patton & McIlveen, 2009; Magnusson, 2019). Currently, little evidence on orthotics and prosthetics from South Africa are published in accredited peer reviewed scientific journals. For example, only six articles by South African researchers were published between January 2015 and June 2020 in Prosthetics and Orthotics International, the official journal of the International Society for Prosthetics and Orthotics. There is also a global need for continuous research in orthotics and prosthetics since technology in the field is constantly advancing (Turner-Smith & Devlin, 2004).

The findings showed that profession specific postgraduate education was not available in South Africa. This was a shared reality. As Magnussen (2019) states, there is the desire for further education and training in orthotics and prosthetics for a master's degree as an opportunity to advance service delivery in Africa. This desire was also expressed in a study done in a developing country that assessed the training provided at the Training Centre for Orthopaedic Technologists (TATCOT), which is one of the only ISPO accredited training centres located in Southern Africa (Magnusson, 2016; ISPO, 2019. Available: https://www.ispoint.org/page/Programmes). A shortage of postgraduate education can lead to a lack of professional advancement, research, and growth in the field. Jesus, Landry, Dussault & Fronteira (2017) confirms the opinion of current participants that postgraduate education assists in securing more recognition for a profession. Professional recognition and research may lead to more recognition at policy level, and thus improved focus on the orthotic and prosthetic needs of patients as part of rehabilitation (Jesus *et al*., 2017).

Participants felt that the current pre-graduate qualifications in South Africa are not on par with international standards and that postgraduate education could be a solution to this challenge. This concern is valid since, presently, no South African pre-graduate qualification is accredited by ISPO International Society of Orthotics and Prosthetics, who together with the World Health

Organization developed standards and guidelines for orthotics and prosthetics schools globally (WHO, 2017; ISOP, 2019). However, the quality of pre-graduate education in the country falls outside the scope of this study. Suffice to say that postgraduate education programmes cannot fill the void left by substandard pre-graduate education. Basic tertiary qualifications in orthotics and prosthetics are an aspect that requires a study of its own.

Higher education institutions have long-standing traditions of research and scholarship and expect that personnel will add to the growth of their particular vocation through scientific research. Regrettably, for O&Ps, the move to the university environment has come later for their profession than for other professional groups in health care. Thus, a culture of postgraduate education and research has not developed in prosthetics and orthotics to the extent that it has in other health service professions (Ramstrand & Brodtkorb, 2008). Therefore, there are, at present, not enough O&Ps with the qualifications to guide postgraduate education and research in the profession. Given the limited number of Orthotists and Prosthetists that have the educational background to prepare them for independent research, coupled with the relatively small size of the profession as a whole, it is not surprising that the majority of orthotics and prosthetics research has been conducted by representatives from other professional groups (Ramstrand & Brodtkorb, 2008) In an analysis of the development of EBP in physiotherapy, Sackley (1994) provided to few research experts, funding and time limitations as well as poor motivation to undertake research as possible explanations. It is possible that the orthotics and prosthetics profession suffer from the same hindrances.

Current results cannot be seen as representative of the larger body of Orthotists & Prosthetists in South Africa but might be an indication of a shortage of O&Ps with masters and doctoral qualifications; a prerequisite for teaching at a postgraduate level and developing postgraduate programmes (Smith *et al*., 2016). Faculty developing the curriculum and training material in orthotics and prosthetics programmes should be in possession of at least a Master`s degree, but preferably a Doctoral degree. O&Ps with educational, clinical and technical experience should be identified for education positions. They must be supported with time off and additional help such as funding to obtain an advanced degree in education (Bolier *et al*., 2013).

Developing and maintaining orthotic and prosthetic education programs are costly. The practical nature of the training require access to lecture and manufacture space as well as access to expensive materials and machinery. Administrative and financial support are prerequisites to

developing effective orthotic and prosthetic graduate programs. Programme development must be supported by the university`s chancellor, faculty deans, professors and administrative staff. Diverse bases of subsidy must be also available as additional funding. Working relations with manufacturers in the orthotic and prosthetic industry, clinical orthotists and prosthetists, and the medical and related health care community are equally necessary (Bolier *et al.*, 2013).

Current participants did not identify the cost of O&P education programmes (as was also the case with participants from Ghana (Aduayom-Ahego & Ehara, 2016) and authors form further afield (Hovorka *et al.*, 2002a; Hovorka, Shuur *et al.*, 2002b)) as an inhibitor to establishing professions specific postgraduate programmes. Due to this cost, it will be beneficial if profession specific postgraduate programmes are developed at the three universities currently involved in pre-graduate education of Orthotists and Prosthetists.

There are generic postgraduate educational programmes catering for health professions that promote a holistic health care approach, which are open to O&Ps. It is important for O&Ps to enrol in generic programmes because collaboration and clinical decision-making can be improved through education programs that facilitates interprofessional health care education (Lapkin, Levettt-Jones & Gilligan, 2011). Participants disagreed on whether these programmes were sufficient in number, this is also evident when one conducts a desktop search on postgraduate programmes for O&Ps in South Africa. Throughout South Africa, there exist limited educational institutions faced with an increased number of enrolments, which could pose another challenge (Dlungwane *et al.*, 2017). Increased demand might render the available generic programmes insufficient in number.

The generic programmes that were available were seen as not addressing the needs of O&Ps sufficiently. Generic programmes can increase knowledge capacity in rehabilitation and health care services but, going forward, should consider diversifying to include tutors knowledgeable in orthotics and prosthetics, with teaching material relevant to this professional group, to be more inclusive of orthotists and prosthetists. There is a need for incorporating an integrative healthcare approach to inspire interprofessional education in health care (Brooks, Koithan, Lopez, Klatt, Lee, Goldblatt, Sandvold & Lebensohn, 2019). Developing current presenters of these programmes could assist in strengthening capacity within generic postgraduate programmes to enhance inclusion of orthotists and prosthetists in these programmes (Dlungwane *et al.*, 2017).

Participants preferred structured masters with course work. A web based/online format were the preferred mode of delivery, as online programmes will be accessible to most Orthotists and Prosthetists in South Africa. Orthotists and Prosthetists in South Africa are a relatively small group and located in different areas around the country (Mduzana *et al*., 2020). Thus, on campus contact programmes will be more expensive and less accessible to many when compared to online programmes. Research has found that web-based programmes help alleviate cost and time challenges since it is more accessible, with participation from home at times convenient to the student (Turner-Smith & Delvin, 2004).

While deeming postgraduate education important, participants were fully aware of the barriers to pursuing postgraduate education. In a study from Ghana, Aduayom-Ahego & Ehara (2016) also identified cost, time, funding, and few available programmes as external barriers to postgraduate education in prosthetics and orthotics. These barriers coupled with the lack of internal motivation and extremal incentives lead to a lack of interest amongst Orthotists and Prosthetists in pursuing postgraduate education. Ongoing engagement with O&Ps and the industry at large is a vital starting point to overcome these barriers. It is essential for education institutions and all industry stakeholders to come together to effectively develop more interest in Orthotists and Prosthetists, to engaging in postgraduate education and creating more opportunities for postgraduate education (Brooks *et al*. 2017; Lehane, Leahy-Warren, O'Riordoan, Savage & Drennan, 2019).

Therefore, if Orthotists and Prosthetists were granted access to participation in profession specific postgraduate education professionals would be empowered to maximised their potential to succeed. This would be by a way of having an available and accessible O&P specific qualification for professionals in South Africa (Gidley *et al*., 2010).

Chapter 7

Conclusion and recommendations

7.1. Conclusion

The aim of the study was to explore the availability, importance and accessibility of postgraduate education for Orthotists and Prosthetists in South Africa. In terms of the theoretical framework guiding this study, participants had no access to postgraduate specific orthotics and prosthetics education and limited generic programme access because there is currently no higher education institution offering an O&P postgraduate programme in South Africa. This meant less postgraduate engagement and less empowerment for O&P.

Figure 7.1 shows a suggested spiraling where the shortage of available programmes, and insufficient motivation among O&Ps to pursue what postgraduate education programmes are available, might result in a limited number of O&Ps with the necessary qualifications to develop postgraduate education programmes in orthotics and prosthetics in South Africa. Together these challenges might have contributed to a lack of advancement and recognition of the profession in health care circles.

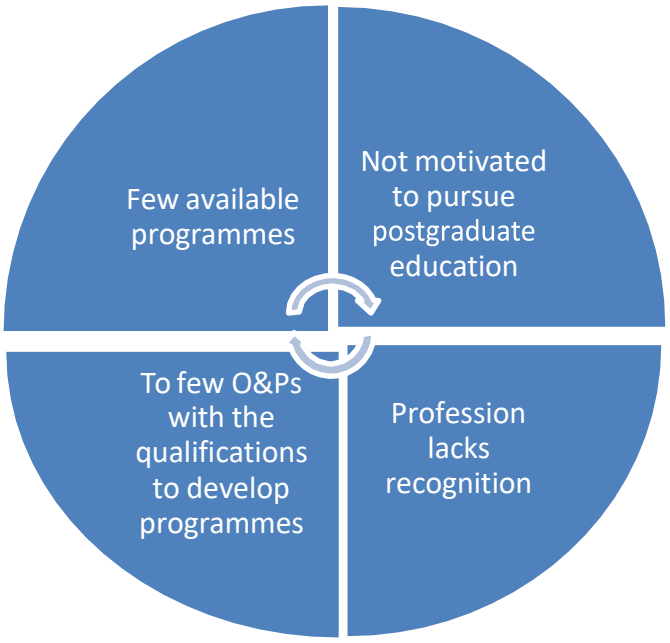

Figure 7. 1: Integrated nature of factors that negatively influence O&P postgraduate education (Developed by author)

7.2. Recommendations

It is recommended that the three tertiary institutions that currently provide pre-graduate teaching in O&P collaborate in the development of discipline specific postgraduate programmes in orthotics and prosthetics in South Africa that is recognised locally and internationally. These programmes must have a structured masters with course work with a format that is web based or online as mode of programme delivery. Programme content and teaching methods should be studied as it is developed and implemented. Existing generic programmes suitable for Orthotists and Prosthetists in South Africa must be identified and assisted by O&Ps to become more inclusive of orthotics and prosthetics educational needs. The quality and effectiveness of pre-graduate orthotic and prosthetic education in South Africa should be studied.

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Appendices

Appendix A

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM FOR ONLINE SURVEYS/QUESTIONNAIRES

TITLE OF RESEARCH PROJECT: Availability, importance and accessibility of postgraduate education for Orthotists and Prosthetists in South Africa: A mixed method study

I would like to invite you to take part in a research project, which involves the completion of an email questionnaire. Your participation is **entirely voluntary** and you are free to decline to participate or to stop completing the questionnaire at any time, even if you have agreed to take part initially.

This study aims to… / What is the study about?

The study aims to explore availability, importance and accessibility of postgraduate education for Orthotists and Prosthetists in South Africa. In phase 1 of the study questionnaire and semi -structured interview will be sent via email to you. The study will be done throughout South Africa. 226 Orthotists\ Prosthetists will be randomly sampled from the Health professions council of South Africa (HPCSA) registered Orthotists and Prosthetists list and be invited via email to participate in the study. Phase 2 of the study is a semi-structured interview will be email to participants are purposively selected to ensure that those who access different types of postgraduate education, hold opposing views on the importance, need and preferred formats of postgraduate education and also experience barriers to education are included.

You are being asked to participate because…/ Why are you being asked to participate?

You are being asked to participate since you are an Orthotist/Prosthetist that is currently working in South Africa and can provide valuable information on the topic under study.

If you agree to participate you will be requested to…/ What will participating in the study entail?

You will receive a structured questionnaire with 17 questions via email. You will be asked to complete a 15-20minute questionnaire and email it back to me. You might also be handpicked based on the answers of the first questionnaire to share your opinions in greater depth through

the completion of a further more open-ended 30-45 minute semi-structure interview that will be sent to you via emailed and email back to me.

The potential benefits of this research are… / Will you benefit from taking part in this research?

There are no immediate direct benefits for you in participating in the research.

The potential risks involved in participating in this research are…/ Are there any risks involved in your taking part in this research?

There are no physical risks involved in participation in the research. There is a small social risk as keeping email responses anonymous are not possible. However, the information sought is not of a sensitive nature. I will also take all possible precautions to keep the information private through saving it on password-protected devices and deleting it from my inbox.

You can phone or email the Principal Investigator of this study, Pearl Boshof at 084 9736 433, pearlb23@gmail.com if you have any questions about this study or encounter any problems.

This study has been approved by the **Health Research Ethics Committee at Stellenbosch University.** The study will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, and the Department of Health Ethics in Health Research: Principles, Processes and Studies (2015).

You can phone the Health Research Ethics Committee at 021 938 9677/9819 if there still is something that concerns you about how this study is being conducted, or if you have a complaint.

You are welcome to save and/or print a copy of this information and consent form.

By completing the questionnaire and emailing it back to me, you are confirming that you are over 18 years old and have read and understood the above explanation about the study, and that you agree to participate. You also understand that your participation in this study is strictly voluntary.

Appendix B

Questionnaire to explore the availability, importance and accessibility of postgraduate education for Orthotists and Prosthetists (O&Ps) in South Africa.

My name is Pearl Ignacia Boshof, I am a Health Professions Council of South Africa (HPCSA) registered practicing Medical Orthotist and Prosthetist currently studying at Stellenbosch university doing my Master's degree in Human rehabilitation studies: Thesis.

I would like to ask you some questions about your educational background, experiences and future endeavours, in order to explore your opinion on the availability, importance and accessibility of postgraduate education for Orthotists and Prosthetists in South Africa. This information will be used to determine the needs, barriers, future recommendations and possible topics to be investigated or researched in postgraduate education in South Africa for Orthotics and Prosthetics.

This questionnaire should take about 15- 20 minutes of your time. If anything is unclear please contact me at pearlb23@gmail.com. Please return to pearlb23@gmail.com

Participant No:
(office use)

Demographic information

1. Please indicate your gender:_____
2. How old are you? _____
3. In what province do you live? (tick appropriate block)

Western Cape	
Eastern Cape	
KwaZulu Natal	
Free State	
Northern Cape	
North West	
Gauteng	
Limpopo	
Mpumalanga	

4. How long have you been qualified as an Orthotist/Prosthetist in years? _____

5. Tick the box that indicates your formal qualification in Orthotics and Prosthetics

National Diploma	
Bachelor of Technology degree	
Degree	
Master's Degree	
Doctorate	

6. Do you have any additional postgraduate qualifications? _____

7. If yes please state these

8. Current employment status

Self employed	
Employed in private sector	
Government employed	
Employed by a teaching institution	
Other	

If other please specify: _____

Postgraduate education: availability, importance and accessibility

9. Postgraduate education is important to me (tick appropriate block)

Not at all	A little	Quite	Extremely

10. There is sufficient profession specific postgraduate education programmes for O&Ps in South Africa (tick appropriate block)

Not at all	A little	Quite	Extremely	Do not know

11. There is sufficient generic postgraduate education programmes for O&Ps in South Africa (tick appropriate block)

Not at all	A little	Quite	Extremely	Do not know

12. Do you have any specific postgraduate education needs? _____

If yes, please specify:

13. List the things that make it difficult for you to engage in postgraduate education

14. I would prefer postgraduate education to be provided as:

Traditional programmes offered at learning institutions	
Distance learning	
Web based / online programmes	
Other	

If other please specify: _____

15. I would prefer postgraduate education to be: (tick all appropriate blocks)

O&P discipline specific	
Generic	

16. I would prefer the following postgraduate programmes (tick all appropriate blocks)

Postgraduate diploma	
Structured masters with course work	
Masters by dissertation	
Doctoral	
Other	

If other please specify: _____

17. Would you be willing to participate in a follow up interview? _____

Thank you for your participation.

Appendix C

Semi structured interview to explore availability, importance and accessibility of postgraduate education for South African Orthotists and Prosthetists.

Thank you for your participation in the previous questionnaire, which aimed at exploring the "Availability, importance and accessibility of postgraduate education for Orthotists and Prosthetists in South Africa". Your role is appreciated and you have been purposively sampled to participate in the second phase of the study.

Your views and comments in this semi-structured interview remain solely for the purpose of the study mentioned above.

Please answer the questions below in paragraph form. Please take as much space as you need per question. It should take 30 – 45 minutes of your time. If anything is unclear please contact me at pearlb23@gmail.com. Please return to pearlb23@gmail.com after completing.

1. You have indicated in the questionnaire that postgraduate education is (*add important or not important depending on the answer in the questionnaire*) to you. Could you please explain why this is the case?

2. Why do you feel there is *(add sufficient or insufficient depending on the answer in the questionnaire)* profession specific postgraduate education opportunities for O&Ps in South Africa?

3. Why do you feel there is (*add sufficient or insufficient depending on the answer in the questionnaire*) generic postgraduate education opportunities for O&Ps in South Africa?

4. You have mentioned that (*add specific barrier*) makes it difficult for you to engage in postgraduate education. Could you please tell me more about that?

5. Why would you prefer (*add on line, distance or traditional programmes depending on the answer in the questionnaire*) postgraduate O&P education?

6. In your opinion why is it important to offer (*add discipline specific or generic depending on the answer in the questionnaire*) postgraduate education programmes for O&Ps in South Africa?

7. If you have explored or participated in postgraduate programmes previously could you please tell me about the experience?

8. Any other comments you wish to share?

Thank you for your participation.

Appendix D

Dear Colleague

I hope this email finds you well. My name is Pearl Boshof, I am currently a Masters in Human rehabilitation studies student at the University of Stellenbosch. I would like to invite you to participate in a research project that involves the completion of an emailed questionnaire and you may be selected to also complete a semi-structured interview.

The study aims to explore the availability, importance and accessibility of postgraduate education for Orthotists and Prosthetists (O&Ps) in South Africa.

Please find attached an information leaflet and consent form that provides more information about the study.

Furthermore, you can phone or email me, Pearl Boshof at 084 9736 433, **pearlb23@gmail.com** if you have any questions about this study or encounter any problems.

If you are willing to participate, please complete the attached 15 - 20 minute questionnaire and email it back to me at **pearlb23@gmail.com.**

Thank you for your time

Kind regards

Pearl Boshof

Appendix E

Dear Colleague

I hope this email finds you well.

You should have received an invitation to participate in a research project to explore the availability, importance and accessibility of postgraduate education for Orthotists and Prosthetists (O&Ps) in South Africa.

This is a special reminder to you to please complete the questionnaire and mail it back to me at pearlb23@gmail.com. If you are willing to participate in the study.

Thank you for your time

Kind regards

Pearl Boshof

Appendix F

Dear Colleague

Thank you for your participation in the study to explore the availability, importance and accessibility of postgraduate education for Orthotists and Prosthetists (O&Ps) in South Africa through completing the questionnaire. Your role is appreciated and you have been selected to take part in the second round of data collection.

Please find an attachment with open-ended questions to complete.

This should take you 30-45 minutes of your time. If anything is unclear, please contact me at pearlb23@gmail.com.

Please return to pearlb23@gmail.com after completing.

Thank you for your time

Kind regards

Pearl Boshof

Appendix G

Record of responses received

	First Email date:	Week 1 – 1st email reminder	Week 2 -2nd email reminder	Week 3 – FINAL REMINDER
		Responses received: Refer to the Excel spread sheet		
Structured questionnaire	First Email date: 12 August 2019	Week 1 19 & 20 August 2019	Week 2 26 & 27 August 2019	Week 3 03 September 2019
	No Emailed 255 (11 returned undelivered emails, 4 participants (2 by 2 sharing each sharing emails)	No 255 – 18 = 237	No 237 – 16 = 221	No 221 – 9 = 212
Structured questionnaire	First Email date: 12 August 2019	Week 1 19 & 20 August 2019	Week 2 26 & 27 August 2019	Week 3 03 September 2019
Semi-structured questionnaire	12 September 2019	19 September 2019	26 September 2019	03 October 2019
	No Emailed	No 19-1= 18	No 18-1=17	No 17-3=14

	20-1=19 emails sent out to participants (as per willingness to participate)			