



Cape Peninsula
University of Technology

**UNIVERSAL DESIGN IN ACADEMIC DRESS: A PRACTICE-BASED STUDY OF
DIFFERENTLY ABLED PERSONS IN CAPE TOWN, SOUTH AFRICA**

by

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Declaration

I, Sindiswa Papa, declare that the contents of this thesis represent my own unaided work, and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

A handwritten signature in black ink, appearing to read 'S Papa', written in a cursive style.

Signature:

Date: 20/ 02/ 2023

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Dedication

This study is dedicated to all differently abled graduands and future graduands, may your needs be met in this area of academic dress, so that you may fully enjoy the fruits of your labour by attending your graduation ceremonies. I hope this study contributes to change and inclusivity of everyone.

A special dedication goes to my beloved sister Zanele Shirley Soloshe-Dukwe whose love for her children was displayed in a way that I have never seen nor experienced. Your resilience and will to live while enduring pains of a silent killer is something we will never forget. You will forever live in our hearts Madlamini, mzukulwana waMatshawe namaNgwevu.

Abstract

This research explored inclusive academic dress for differently abled persons with mobility impairments, within institutions of higher learning. The main research question sought to establish, how can Universal Design Principles (UDPs) be adopted to the design of inclusive academic dress for differently abled persons? Although previous work that addressed apparel for differently abled persons has been done by fashion designers in America and Europe, it failed to address inclusive academic dress, suitable for differently abled persons. The challenge of unsuitable academic dress for differently abled persons were addressed, working with mobility impaired participants. Universal Design is the theoretical framework of this study with the Universal Design Principles used to analyse the data collected. Practice-Based Research (PBR) is the methodology and User-Centred Design guided in the design process of this study. Individual semi-formal online interviews were conducted with differently abled participants who are mobility impaired graduands. The objective was to learn about their physical and emotional personal experience of wearing the conventional academic dress. Data collected gave insight on their needs, to ensure inclusivity in the inclusive design. Using the thematic analysis method, the data were analysed, thereafter an inclusive academic gown was developed. User testing of the inclusive design was done, and feedback given by participants, regarding the fit and feel of the inclusive design.

It was discovered that, indeed, there is a need for inclusive academic gown for differently abled persons in wheelchairs. It was established that the full length inclusive academic gown is suitable for both abled bodied people and differently abled persons. In addition, it was established that because all disabilities are unique, body requirements differ for individuals. The needs of people whose unique body shape may not be catered for in the inclusive academic gown design, may be addressed individually by arranging for custom-made academic gown. A future study on custom-made academic gown for differently abled people may be necessary, in the interest of inclusivity. This may change perspective that “one design fits all”. The provision of suitable academic dress for differently abled person is a need that can be addressed by including an inclusive academic gown design in the assortment of academic dress.

Keywords: Universal Design, Universal Design Principles, inclusive dress, differently abled, academic gown, academic dress.

Table of Contents

Declaration	ii
Acknowledgements	iii
Dedication	iv
Abstract v	
Table of Contents	vi
List of Figures.....	ix
List of Tables.....	x
Clarification of Terms	xi
Abbreviations	xii
Chapter 1 : Introduction.....	13
1.1 Introduction.....	13
1.2 Background to the research problem	16
1.2.1 Academic dress	16
1.2.2 Accessibility and design.....	17
1.2.3 Empathy through design.....	19
1.2.4 Physical and emotional impact	20
1.2.5 Social engagement.....	21
1.3 Research problem statement.....	21
1.4 Research aims and objectives	22
1.4.1 Aim	22
1.4.2 Objectives.....	22
1.4.3 The purpose of this study	22
1.5 Research questions.....	23
1.5.1 Primary research question (PRQ).....	23
1.5.2 Research sub-questions (RSQs)	23
1.6 Significance of the study	23
1.7 Research approach	24
1.7.1 Research philosophy	24
1.7.2 Research type	25
1.7.3 Research strategy	25
1.7.4 Time horizon.....	25
1.7.5 Sampling strategy.....	26
1.7.6 Data collection method	26
1.8 Theoretical framework	26
1.9 Delineation	27

1.10	Structure of the study.....	27
Chapter 2 : Literature Review		29
2.1	Introduction.....	29
2.2	State of higher education in South Africa	29
2.3	Inclusivity in institutions of higher learning	30
2.4	Defining differently abled persons.....	31
2.5	The need for an inclusive design approach in fashion.....	32
2.6	Theoretical framework	36
Chapter 3 : Research Methods		38
3.1	Introduction.....	38
3.2	Research questions	38
3.2.1	Primary research question	38
3.2.2	Research sub-questions	38
3.3	Research aim	38
3.4	Objectives.....	38
3.5	Research design and methodology.....	39
3.5.1	Research philosophy: Interpretivism	39
3.5.2	Qualitative research.....	39
3.6	UDPs and UCD approach.....	40
3.6.1	UD in Fashion: History	40
3.6.2	Guidelines	47
3.6.3	User-centred design	48
3.7	Sample group	51
3.8	Interviews	51
3.9	Limitations	53
3.10	Ethics	54
3.11	User testing: Practical process	56
3.12	Data analysis	57
3.12.1	Thematic analysis.....	59
3.12.2	The six steps by Braun and Clarke	59
Chapter 4: Findings.....		61
4.1	Introduction.....	61
4.2	Data analysis	61
4.2.1	Initial themes found in data	64
4.2.2	The experience of the users with the conventional academic gown (Challenges & Needs Assessment).....	71

4.2.3	UDPs guide the design of an inclusive academic gown (First Iteration Design and Produce Prototype 1).....	77
4.3	First Iteration: Design and sample process	78
4.4	Fit & feedback of from user: prototype 1	86
4.4.1	Evaluate	86
4.5	Second Iteration: Implementation of feedback from prototype 1 (Alter, Design and Produce Prototype 2).....	91
4.5.1	Technology Station	91
4.6	Fit & Feedback: Evaluate Prototype 2.....	95
4.6.1	One abled body participant	95
	Full length academic gown	95
4.6.2	One differently abled participant: female wheelchair user	95
	Shorter back inclusive academic gown	95
	Longer back inclusive academic gown.....	96
4.6.3	Technical drawings of graduations gowns	97
4.7	Photoshoot	99
4.7.1	Conventional academic gown	99
4.7.2	Full length inclusive academic gown.....	100
4.7.3	Shorter back inclusive academic gown	102
4.8	Conclusion.....	102
Chapter 5: Conclusion and Recommendations		104
5.1	Introduction.....	104
5.2	Summary	104
5.2.1	Research problem statement.....	104
5.2.2	Primary research question	105
5.2.3	Research sub-questions	106
5.2.4	Research aim	106
5.2.5	Research philosophy	107
5.3	Discussion of the findings	108
5.3.1	Methodological reflections	108
5.3.2	Seven conclusions that were a result of this research.....	111
5.3.3	Contributions of this study and Lessons Learnt.....	115
5.3.4	Points to take away	117
5.4	Recommendations.....	117
5.4.1	Policy making and practice	117
5.4.2	Further studies.....	118
5.5	Conclusion.....	118

List of Figures

Figure 1.1: a) Graduation gown – Diploma gown in textured polyester (back view); b) Graduation gown – Diploma gown in textured polyester (front view)	13
Figure 1.2: New-look academic procession gowns (2019).....	14
Figure 1.3: Oxford College Senior Class	17
Figure 1.4: The process of Universal Design.....	20
Figure 3.1: Ron Mace	46
Figure 3.2: Seven original UDPs	46
Figure 3.3: The User-Centred Design approach (adapted from ISO, 2010).....	49
Figure 3.4: Issues to be mindful of when researching differently abled persons	54
Figure 3.5: Design thinking process (Source: Burgstahler, 2005).....	56
Figure 3.6: The Process diagram during iteration phases.....	57
Figure 3.7: Six-step thematic analysis guide.....	60
Figure 4.1: Initial highlighting process in Taguette.....	62
Figure 4.2: Initial bucket codes in Taguette	63
Figure 4.3: Initial codes and quotes in Excel.....	63
Figure 4.4: Initial themes in Excel.....	64
Figure 4.5: Process diagram	66
Figure 4.6: Sketch 1 – Original design before the interviews	79
Figure 4.7: Design after the interviews	80
Figure 4.8: Inclusive academic gown (CAD Technical drawing: shorter back)	81
Figure 4.9: Inclusive academic gown, Source (CAD Technical drawing: longer back)	81
Figure 4.10: Manual pattern making process of the first iteration.....	82
Figure 4.11: Cutting and sewing the first iteration of the inclusive academic gown design.....	82
Figure 4.12: Front and back view of the first sample. First fit on the mannequin).....	82
Figure 4.13: Fitting prototype 1 on the participant.....	88
Figure 4.14: back view; front view; back view showing vent detail, side view of the inclusive academic gown (full length design)	92
Figure 4.15: back view; front view; right hand side view; left hand side view of the inclusive academic gown (short back length design).....	92
Figure 4.16: Fitting prototype 2 on an abled body participant	95
Figure 4.17: Fitting prototype 2 (shorter back) on a wheelchair user participant	96
Figure 4.18: Fitting prototype 2 (full length) on a wheelchair user participant.....	96
Figure 4.19: Graduation Technical Drawing 1.....	97

Figure 4.20: Technical drawing after fitting session (full length).....	98
Figure 4.21: Graduation Gown Technical Drawing 2	98
Figure 4.22: Technical drawing after fitting session (shorter back length).....	99
Figure 4.23: Conventional gown fitting and photo shoot session.	100
Figure 4.24: Full length inclusive academic gown fitting and photo shoot session	101
Figure 4.25: Full length inclusive academic gown fitting and photo shoot session	101
Figure 4.26: Shorter back inclusive academic gown fitting and photo shoot session	102

List of Tables

Table 1.1: Design approaches with inclusivity and accessibility as the aim	19
Table 3.1: UDPs and design solutions in apparel	47
Table 3.2: Participant identity and credentials	50
Table 4.1: Challenges and needs assessment table.....	67
Table 4.2: Solutions through Universal Design (Source: Researcher)	75
Table 4.3: Testing of prototype one with one wheelchair user	84
Table 4.4: Second iteration: Implementation of feedback from prototype 1.....	89
Table 4.5: Second iteration – Testing of prototype 2.....	93
Table 5.1: UDPs, themes and solutions.....	111
Table 5.2: Implications of research choices made in this study	113
Table 5.3: Alternative choices available but not chosen for this study	114

Clarification of Terms

Term	Clarification
Academic dress	When attending commencement or graduation ceremonies, both students and academic officials dress formally in academic dress (McCullum, 2005).
Academic gown	A below-knee length robe that is open at the centre front, with wide sleeves (McCullum, 2005:1).
Adaptive clothing	Clothing can be adjusted, when necessary, to deal with different situations (Oxford Learner's Dictionary, 2020).
Africanism	An African custom, characteristic, or belief. A word, phrase, grammatical construction or other feature originating in or peculiar to an African language. Devotion to African customs, traditions, etc. (Collinsdictionary.com).
A-Line	The fronts of A-line garments are often cut in one piece, with darts for fitting, and the skirts often have no waistband (fashioncentral.com).
CD-ROM	A compact disk on which a large amount of digitized read-only data can be stored (Dictionary.com).
Differently abled	Having a disability (merriam-webster.com). Given the background on the evolved disability terminology, this article suggests that <i>difabel</i> should also be adopted into broader English usage i.e., 'diffability'/ differently abled (Suharto et al., 2016; tandfonline.com).
Disabled	Impaired or limited by a physical, mental, cognitive, or developmental condition (merriam-webster.com).
Mobility impaired	The ability to move from one place to another is damaged or not functioning normally (Oxford Learner's Dictionary, 2020). The lack of adaptive or appropriate clothing or apparel for people living with disabilities can become a barrier, preventing engagement in meaningful activities, yet these barriers are not often explicitly identified (Kabel, tandfonline.com).
Practice-based Research	"Practice-based Research is an original investigation undertaken to gain new knowledge partly using practice and the outcomes of that practice. Claims of originality and contribution to knowledge may be demonstrated through creative outcomes which may include artifacts such as images, music, designs, models, digital media, or other outcomes such as performances and exhibitions. Whilst the significance and context of the claims are described in words, a full understanding can only be obtained with direct reference to those outcomes" (Candy, 2006:3).

Abbreviations

Abbreviation	Full Word/Term
APA	American Psychological Association
EU	European Union
ID	Inclusive Design
ICF	International Classification of Functioning
OECD	Organisation for Economic Co-operation and Development
PoUD	Principles of Universal Design
UCD	User Centred Design
UD	Universal Design
WHO	World Health Organisation

Chapter 1 : Introduction

1.1 Introduction

For all students, graduation day is a momentous occasion because it marks the end of their academic careers. Students receive awards on graduation day for their diligence and hard work. Academic dress is the attire that is mandatory for all graduands to wear. This special uniform is defined as, “the formal attire worn by students and officials at the commencement or graduation ceremony. This includes a flowing gown, a hood or cape, and some sort of headwear; the contemporary form of this ensemble depends on the rules dictated by the institution with which the student or official is associated” (McCallum, 2005:1). The commonly used design in South African institutions of higher learning is a below-knee length gown that is open at the centre front, with wide sleeves as shown in Figures 1.1 and 1.2. According to Groves (2001), the fit and shape of the gown may vary depending on the level of education obtained for example a bachelor's gown, Masters' gown, doctoral robe, and undergrad gown. Universities South Africa in their guideline state that all institutions of higher learning, should practice inclusivity and embrace diversity (USAf, 2023: 1).



Figure 1.1: a) Graduation gown – Diploma gown in textured polyester (back view); b) Graduation gown – Diploma gown in textured polyester (front view)

(Source: <https://www.birchs.co.za>)

The purpose of the qualitative research done in this study was to investigate whether, the conventional academic dress is inclusive for differently abled people within institutions of higher learning. The practice-based approach was informed through the qualitative research and concerned with the redesign of the conventional academic gown. Since education was designed to be exclusive, differently abled people were never given the opportunity to enroll in higher education and, as a result, never required gowns that could suit different body types. The design considerations were made with able-bodied persons in mind, not particularly those who are physically challenged and may have limited physical movement. A more inclusive academic gown is needed to ensure that all graduands experience inclusivity in their diversity as outlined in the guidelines (USAf, 2023: 1). According to Kabel, 2016. the lack of adapted or appropriate apparel for people with disabilities can be a barrier to meaningful activity participation, however, these barriers are not always clearly identified (Kabel et al., 2016).

In pursuit of inclusion and a gown that represented an African identity, the Cape Peninsula University of Technology embarked on a project of decolonising the academic procession attire in the institution in 2019. In unveiling the attire, it was stated that “after 14 years the Cape Peninsula University of Technology (CPUT) is retiring their academic gowns and will be unveiling its new African-inspired procession attire during the Summer Graduation series” (Fredericks, 2019:1). The new-look academic dress is shown in Figure 1.2. This research considers the need for inclusivity that goes beyond cultural identity and aims to include Universal Design Principles (UDPs) in the design of an academic gown. Inclusion should go beyond culture like the case of CPUT example below Figure 1.2, and differently abled graduands are given pride, comfort, movement, capacity, etc. as equals in their graduation. The research aims to demonstrate ways in which a more suitable academic gown can be designed.



Figure 1.2: New-look academic procession gowns (2019)

(Source: <https://www.cput.ac.za/newsroom/news/article/3934/new-gowns-for-graduation-series>)

The statistics from the Department of Education in South Africa do not indicate the number of persons with disabilities in national institutions of higher learning. However, in the case of CPUT 241 differently abled persons formed part of their campus community in the year 2014, with 60 impaired mobilities such as: paraplegic, amputee, quadriplegic, and cerebral palsy (CPUT, n.d.).

Body impairment varies in its severity and the type of disease or injury causing the difficulty. These difficulties may restrict a person when donning and doffing depending on the extent of the impairment. Montemezzo and Santos (2002:9) refer to clothing as “a second skin and an extension of the wearer’s body. The relationship between a clothing item and the user should provide the wearer with total comfort”. Clothing items do not only serve the purpose of covering the body, but they also relate to social conditions and the identity of the wearer. The value that the wearer bestows on the clothing item is based on usability, comfort, pleasantness of the garment, enjoyment, and satisfaction of the individual needs (Das Neves et al., 2015). When designing clothing items, designers should be mindful of the user, taking into consideration the abilities, needs, and limitations of the user with the aim of inclusion of all users in the final product (Vianna & Quaresma, 2015).

Fashion history shows that the symbolic character of clothing items was linked with the socio-cultural aspirations of a certain period, and that influenced the way the fashion items of the period were designed (Das Neves et al., 2015). Over the centuries we have seen this phenomenon, however, there is no evidence that the academic dress was influenced by the fashion narrative above nor by the needs of the people who wear it, it remained alike. In Europe then later America minor changes in the design were seen in the 1490s, from a closed gown worn with a cape to a standard academic dress that consisted of an open-front gown with wide sleeves, in black (McCallum, 2005). This adjusted design was later adopted in various parts of the world. It is necessary to frame the Eurocentric origin of education in South Africa therefore all the rituals and of the gown. The need to decolonise curricula extends to the academic rituals and gowns. Looking at the conventional academic dress on offer in most institutions of higher learning in South Africa, the design is still an open-front gown with wide sleeves, in black inspired by the Eurocentric design. Similar designs of gowns extend to other fields such as law where judges, magistrates, prosecutors, and attorneys dress up in gowns for court proceedings, as well as churches where bishops and reverends of the church also dress up in similar type of gowns for church services.

This study examined and responded to the suitability of academic dress, particularly the gown, for differently abled persons. In doing this, the history of academic dress as well as the current design used in institutions of higher learning in Cape Town, South Africa were considered. This practice-based research focused on exploring and then being guided by the experience of multiple cases of differently abled people when designing the new academic dress. The study utilised UDPs as an analysis framework in an iterative design process. This was towards improving the inclusivity of all users and explore ways in which design, functionality, accessibility, comfort, and wearability can be improved in academic dress for differently abled persons. The findings from the research informed the product design process.

1.2 Background to the research problem

1.2.1 Academic dress

When comparing the academic gown worn today (Figure 1.1) with the academic gown worn in the 19th century (Figure 1.3) there is no evidence to suggest that academic dress has changed significantly since the times it was first introduced in Europe in the 11th and 12th centuries. The assertion is substantiated by an examination of the silhouette and drape of the two academic gowns seen in the images.

McCallum, 2005 states that scholars used to wear academic dress daily until Oxford and Cambridge universities established strict rules for scholars and officials to wear academic dress on defined occasions such as graduation ceremonies. The wearer rank and the design features of the garment determined the type of academic dress worn by individuals. The British Empire played a role in the spread of this practice to many places of the world (McCallum, 2005). Colonisation of South Africa by the British resulted in academic dress becoming part of the traditions of institutions of higher learning, this leading into the inheritance of the traditional academic dress being introduced in the South African society.

Currently, the proportions of differently abled persons are unknown in this area of dress, therefore they are not catered for. The inclusion of differently abled people in the design of the academic dress has not yet taken place, with regards to the design, functionality, practicality, comfort and fit, in universities in South Africa.



Figure 1.3: Oxford College Senior Class

(Source: www.fashion-history.lovetoknow.com)

1.2.2 Accessibility and design

Numerous design approaches focus on accessibility. This section introduces and compares four distinct design approaches that might be used to integrate accessibility aims into a design process and product. The aim is to offer an understanding of the relationship of Universal design, which serves as a theoretical frame for this study, with similar approaches. Universal Design is described as, “the process of designing environments and products that can be utilised by everyone with minimal modification or specialist design” (Connell et al., 1997).

The following are the four design approaches, namely, Universal Design, Inclusive design, Equity focused design and Product personalisation. Among many journal articles written about the four design approaches in discussion in this section, three approaches are discussed in a journal article, namely, Universal Design, Inclusive design, Equity focused design Inclusivity and accessibility in UX design (Cozlov & Zadorojn, 2022). In another study, Universal Design is discussed specifically as a design approach in apparel (Park et al., 2014). These and some examples of how they have been implemented will be touched on in the following paragraphs.

According to Connell and others, 1997 the Centre for Design developed and introduced UD to encourage designers to include people with disabilities when designing products and spaces (Connell et al., 1997). UD can be applied in diverse fields for example toward achieving inclusion and diversity in architecture (Khalil et al., 2021), in furniture and space design (Catanese, 2012), products such as the wedge lock handle by Thomas Lamb (Catanese, 2012), and apparel such as the Pupa butterfly dress for pregnant women (Park et al., 2014) are just a few examples. The

main objective of universal design is to create goods or environments that accommodate users of all abilities and limitations.

Inclusive design is the following design strategy and is distinct from UD. Inclusive design involves design processes with a focus on addressing specific human requirements. It offers product solutions for those whose needs might still be overlooked by universally designed items. When the “one-size-fits-all strategy” failed to meet the demands of all users, the inclusive design was presented as a remedy (Cozlov & Zadorojn, 2022:385). Inclusive design was applied to clothing design, architecture, and other spheres of life. The expression solves for one to many and alludes to the concept of ID, which focuses on creating solutions that satisfy a wide range of demands (Cozlov & Zadorojn, 2022). In practice, this relates to design decisions that consider personal attributes such as ability, race, economic background, language, age, and gender when designing products and spaces ensuring that they are aligned with the needs of the user. An inclusive design approach often takes a ‘human-centred design approach by including the stakeholder directly in the design process. (Cozlov & Zadorojn, 2022). On the other hand, the equity-focused design approach is like an expansion yet more focused version of UD.

In equity-focused design, the designers concentrate on creating products for demographics that have historically been neglected or overlooked to ensure that historically disadvantaged people gain power. As far as it ensures that everyone receives the same product, this design strategy is like Universal Design; however, the equity-focused design goes further in ensuring that all areas are catered for equally, regardless of gender, size, race, or social status, especially the previously excluded groups of people. For example, the gender of persons is not specified in the equity-focused design, and it is not necessary to do so while completing forms (Cozlov & Zadorojn, 2022).

A further strategy is product personalisation, which also focuses on user needs but adopts a slightly different approach where users have some influence over the creation of their product. According to this strategy, Product personalisation entails users participating in the design process and gaining some degree of design autonomy (Zang et al., 2017). This method involves identifying a set of users and catering to them through mass customization. Like ID, it attends to the user following their wants and is applied in the automotive sector to modify vehicles for users with distinct needs. Additionally, it is applied in the fields of architecture, health, and wellness, where artificial limbs are made, as well as fashion, where adaptive clothing is made to accommodate the needs of users. A summary of definitions and solutions to the user of Universal design, Inclusive Design, Equity-Focused Design and Product-personalisation can be found in Table 1.1.

Table 1.1: Design approaches with inclusivity and accessibility as the aim

(Table constructed by researcher; sources consulted: Connell et al., 1997:281; Cozlov & Zadorojn, 2022:1-2; Martins & Martins, 2012:3; Mugge et al. 2009:72)

Design Approach	Definition according to literature	Simplified definition	Solution to the design/ user
Universal Design	"The process of designing spaces and things that can be used by everyone, with the least amount of modification or specialized design" (Connell et al., 1997:281).	One size fits all. (Cozlov & Zadorojn, 2022:1). A concept that directs the design of items to accommodate all possible users (Martins & Martins, 2012: 3)	Approach aimed at satisfying the needs of all users.
Inclusive Design	"focuses on providing solutions that address a variety of demands" (Cozlov & Zadorojn, 2022).	Solve for one, extend to many. (Cozlov & Zadorojn, 2022:1).	Approach concentrate on solving individual user needs, but has a potential of extending to others.
Equity-focused Design	"designers concentrate on creating products for demographics that have historically been neglected or overlooked. Through equity-focused design, this focus seeks to ensure that historically disadvantaged people gain power" (Cozlov & Zadorojn, 2022:2).	Solve for everyone, ensuring historically disadvantaged groups are on same as everyone (Cozlov & Zadorojn, 2022:2).	Approach aims on solving needs of all, but concentrate on historically disadvantaged people in all areas of life (gender, age, ethnicity, financial status...)
Product Personalization	"Product personalization implies that consumers participate in the design process and obtain a certain degree of design authority" (Mugge, Schoormans, and de Lange, 2007:72).	Solve for a specific group with the user partially participating in product design/ development. (Mugge, Schoormans, and de Lange, 2007:72).	Approach solves user needs with some input from the user in the design of the product.

1.2.3 Empathy through design

Thinking differently about how a product or space would work for people with and without disabilities require empathy on the part of the designer. Aesthetics, engineering alternatives, environmental challenges, safety concerns, industry standards, and pricing are all variables to consider while designing any product or space. Typically, designers think about the average users (Burgstahler, 2005). For instance, when designing a point of sales counter in a retail shop, one can design a counter with different heights to accommodate both the average height and shorter people, as well as those in wheelchairs. To successfully apply UD in the process of designing any product, one must apply the process and Principles of UD. Burgstahler suggests the following process to make UD possible:

1. *Identify the application.* Specify the product or environment (i.e., the building, service, course, website, or other application) to which you wish to apply universal design.
2. *Define the universe.* Describe the overall population (e.g., students in a course or users of a technology) and then the diverse characteristics of potential members of the population for which the application is described (e.g., with respect to gender; age; size; ethnicity/race; native language; and abilities to see, hear, move and manipulate objects, and learn.)
3. *Involve consumers.* Determine how to include people with disabilities and other diverse characteristics in development and implementation of the application.
4. *Adopt UD guidelines/standards/performance indicators.* Create or select existing UD guidelines/standards for your application. Integrate UD practices with other best practices (e.g., in teaching or building design) within the field of the specific application.
5. *Apply UD guidelines/standards/performance indicators.* Apply universal design along with design standards of good practice within the field to the overall design of the application, subcomponents of the application, and maintenance and procurement processes.
7. *Train and support.* Tailor and deliver training and support to stakeholders (e.g., instructors, computer support staff, procurement offices, administrators).
8. *Evaluate.* Include universal design measures in the evaluation of the application, evaluate the application with a diverse group of users, and make modifications based on their feedback.

Figure 1.4: The process of Universal Design

(Source: Burgstahler, 2005:1-2; <http://www.washington.edu/accessit/>)

1.2.4 Physical and emotional impact

Wang et al. (2014) express that it is both meaningful and useful to design clothes for disabled people that fit both their physical and psychological needs. Clothing designs should be user-oriented to meet the needs of end consumers. It should provide a sense of security and comfort, as well as values such as self-esteem, respectability, and prestige (Wang et al., 2014:550-551). The values discussed above, link with the emotional needs of the graduands and are relevant whether one is differently abled or not. Wang et al. (2014) not only discuss physical needs that must be catered for in a garment, but also emotional needs that may be fulfilled by a carefully considered design. This was both interesting and important to note, as humans need to have satisfaction in both emotional and physical as well as other areas of life.

The emotional aspect brought by a garment plays a significant function in academic dress, as for most students the journey of studying is often a challenge both emotionally and physically. If correctly designed for the use and end-user the emotional satisfaction may be positive,

however in this study when the researcher had conversations with the differently abled graduands, the emotional experience of the participants leaned more towards the negative, and this can be linked to the design of the conventional academic gown. It then became important not to discount emotions when it was the graduation period; emotions could be a determining factor for a person to attend or not attend their graduation ceremony.

1.2.5 Social engagement

In a study by Kabel et al. (2017), it was discovered that design problems in clothing create participation barriers for differently abled people. People with mobility challenges missed momentous events due to clothing-related challenges. Both special occasions and everyday life events become more difficult for people with mobility challenges due to the lack of appropriately designed clothing (Kabel et al., 2017:167). Designers can play their part in ensuring the social inclusion of differently abled persons by designing suitable clothing items that consider the body needs of differently abled persons. This study is also a step in the right direction in ensuring the inclusion of differently abled persons in the graduation ceremony. Addressing the inappropriateness of the conventional academic gown for differently abled persons may promote social engagement.

1.3 Research problem statement

Institutions of higher learning recognise the responsibility of full inclusion of all who form part of the community within the higher learning society (Dalton et al., 2019). There are different areas within these institutions in South Africa that are inclusive of staff, students and visitors where the Universal Design Principles have been applied, areas such as infrastructure and teaching and learning (Dalton et al., 2019). However, there is still a gap in ensuring equality and inclusivity in the area of academic dress. There is no evidence showing the inclusion of differently abled in the current design of the academic gown used by most institutions of higher learning in South Africa. Ideally, all human beings should enjoy clothing items that have no issues of misfit or discomfort, however differently abled persons do experience problems with clothing items that are uncomfortable (Nakić & Bogović, 2019). These challenges sometimes prevent differently abled persons from engaging in social activities and may affect a person's personal well-being (Ayachit & Thakur, 2017; Kabel et al., 2017). Fashion designers can play a key role in correcting these clothing challenges experienced by differently abled persons by addressing these challenges when they design their products (Weinswig, 2018).

1.4 Research aims and objectives

1.4.1 Aim

The primary aim of this research was to develop a suitable and inclusive academic dress design for differently abled persons, in particular a gown, as well as contribute to best practices for inclusivity in their policies and procedures in the institutions of higher learning in South Africa.

1.4.2 Objectives

- Through individual interviews, ascertain the core issues regarding the fit, garment behaviour, and the physical and emotional experience of wearing the conventional academic gown, from differently abled participants.
- Find out if Universal Design and its Principles (UDPs) can be used as a guide in the design of an inclusive academic gown alongside findings from one-on-one interviews with users, to address the inclusivity issue of the academic gown.
- Explore suitability of universal policies and practice when applied to inclusive academic gown designs

1.4.3 The purpose of this study

Finding an appropriate academic gown design for differently abled people was the goal of this study, which also aimed to advance best practices for inclusivity in relation to graduation in institutions of higher learning. This study is significant to the researcher because she is a fellow student who believes that graduands ought to celebrate their graduation day and ceremony without experiencing any discomfort because of their academic gown. Clothing that serves a purpose and is comfortable, allows for safe mobility to the wearer, is practical, gives satisfaction and contributes to the enhancement of one's confidence.

Graduation day is a special day where everyone wishes to look and feel good about themselves and their long-awaited achievement. According to Chiwandire and Vincent, 2017 all students in institutions of higher learning ought to be accommodated, both physically able and differently abled, however, the background research indicates that differently abled students are not accommodated in many aspects. Additionally, everyone in South Africa has the right to education, including those who have physical limitations, according to the constitution. There are numerous rules in force requiring higher education institutions to give everyone sufficient physical access to their facilities. But a lot of structures are still inaccessible to those with physical limitations (Chiwandire & Vincent, 2017). Research done within the context of academia describes the experiences of differently abled persons during their studies, with specific reference to access to the physical environments, and inclusivity in teaching and learning (Engelbrecht & De Beer, 2014).

Drawing on the work of Engelbrecht & De Beer, 2014, it is evident that differently abled students in South Africa experience many constraints that make it difficult for them to study at institutions of higher learning with ease. To name a few, these are architectural access: university buildings are sometimes designed in a way that denies access and is sometimes not safe to be used by persons with mobility impairments. This can be seen with doors that may not be wide enough to allow for the passage of wheelchairs, no available lifts, no ramps provided, library access, and parking. Limited disabled parking for students as most universities just provide parking for staff, and medical certificates that the students need to supply annually can become a financial burden (Engelbrecht & De Beer, 2014).

While this information is useful, it does not address the experiences of differently abled graduands in wearing the academic gown in their current form. The purpose of this study is to assess the accessibility and practicality of the academic dress as well, as it forms part of the whole experience of a student in the institution of higher learning. It may be argued that it is an important experience in a student's life, as it is in the completion stage of the journey of a student for many who succeed in their studies.

1.5 Research questions

1.5.1 Primary research question (PRQ)

The main (primary) research question formulated as follows:

PRQ: How can UDPs be adopted for the design of inclusive academic dress for differently abled persons?

1.5.2 Research sub-questions (RSQs)

RSQ 1: How do differently abled persons physically experience wearing conventional academic dress?

RSQ 2: To what extent can the application of UDPs to the design of academic dress contribute to an improved emotional graduation experience?

1.6 Significance of the study

In a study done in India in 2017 the importance of providing suitable clothing items to differently abled persons were highlighted by Ayachit and Thakur, 2017 state that, "although disabled persons can live freely, it would greatly help if they could find apparel that fit their needs" (Ayachit & Thakur, 2017:3). Wearing uncomfortable clothing can make life difficult, and this is especially true for differently abled people whose needs are greater since they need more ease and comfort than the ordinary person to be independent. Ayachit and Thakur, 2017 further states that people with physical limitations can live much better lives if there is a wider variety

of stylish adaptable and suitable clothing available. The above statement by Ayachit and Thakur also applies to this study as it would assist differently abled graduands to have a choice of ergonomically suitable academic gowns during their graduation period.

Physical limitations often lead to special functional requirements of clothing. This is the very reason this research is necessary. This study will benefit differently abled persons who are mobility impaired, the South African institutions of higher learning, as well as clothing manufacturers who produce this product type. It is important to address the challenges experienced by persons who are mobility impaired, as members of the South African population they too should enjoy graduation day to the full as the people who are not mobility impaired do.

This research will inform the institutions of higher learning about the requirements of differently abled persons, where academic dress is concerned. The findings of this study investigate the needs of differently abled academic gown users. By including an item that is user-friendly for differently abled graduands within the academic dress range, institutions of higher learning will be exercising an expanded practice of inclusivity.

1.7 Research approach

1.7.1 Research philosophy

This study adopts an interpretivism approach, which Elster (2007) describes as one that places a great focus on how crucial it is for people to be genuine and participate in social and cultural life. Given that it serves as the foundation for this study, the researcher concurs with this viewpoint. It was crucial to not interfere with the shared data when interviewing the differently abled people who are the study participants and to let them be themselves and share their graduation day recollections honestly. For the researcher as an abled bodied person, this would be difficult to know, listening and representing their data was essential.

According to Kaplan and Maxwell (1994), interpretivism supports the use of qualitative data in the pursuit of knowledge (Myers, 2017). This is particularly true in the case of this study because the researcher was able to understand the needs of the participants through the data collected in interviews which gave the researcher knowledge of the needs of differently abled people. The participants of this study are representatives of the larger population of mobility-impaired students enrolled in institutions of higher learning. Some authors counter that while interpretive research provides context for a study, critiques frequently question the impartiality and reliability of its findings (Perry, 1998). This is particularly true in the case of this study because the researcher was able to understand the needs of the participants, who are

representatives of the larger population of mobility-impaired students enrolled in institutions of higher learning.

1.7.2 Research type

This study used the approach of practice-based research to unpack the needs of the sample group. In practice-based research, an artefact becomes the central contribution of the study. According to Candy (2006:3), Practice-based research (PBR) is an original investigation undertaken to gain new knowledge partly using practice and the outcomes of that practice. Candy further states that, this kind of research has given rise to new concepts and methods in the generation of original knowledge. If a creative artefact is the basis of the contribution to knowledge, the research is practice-based (Candy, 2006:3).

Though like Practice-led Research (PLR), PBR is a different approach in that, PLR focuses on the nature of the creative practice to advance knowledge about or within the practice and results may be communicated without the inclusion of the creative artefact (Candy, 2006:3). Skains (2016), further adds of PBR that, as a scientist, knowledge about the subject through protocol-based testing and observation, always with clear research goals: to investigate and understand the process and relationships of life (Skains, 2016:1-6). This study will use PBR to address direct research questions about the art and practice that might otherwise go unanswered by other methodologies (Skains, 2016:1-6). In other words, address research questions about the suitability of the conventional academic gown that was not challenged in this manner before in South Africa, with the hope of changing the status quo.

1.7.3 Research strategy

The research strategy of this study is based on observing the experiences of mobility-impaired graduands through asking questions, analysing responses, making improvements, reassessing responses of their lived experiences. From these observations of mobility-impaired graduands as stated in the sentence above, an artefact may be developed, this is in line with (PBR) Practice-Based research methodology that this study employs.

1.7.4 Time horizon

The time horizon for this study was cross-sectional wherein data were collected in the second half of 2021 from participants who had graduated at a different period of their lives from different institutions of higher learning in South Africa.

1.7.5 Sampling strategy

The nature of the sample required for this study is specific and therefore the researcher had to enlist the help of the disability unit at a university of technology who has a database of alumni who would take an interest and participate in the study. The disability unit was the starting point for sourcing the required sample, however, it became necessary to introduce another method of sourcing participants when some of the people who initially indicated that they would participate in the study later pulled out and this was in a form of not responding to the researcher's emails or not honoring scheduled appointments for interviews, these were challenges that were experienced. The other method of recruiting participant that was introduced was the snowball effect, where a mobility-impaired person known to the researcher introduced the researcher to other willing participants who took part in the study. Effectively the sampling strategy was a non-probability sampling guided by the research focus of this study.

1.7.6 Data collection method

The qualitative data method was the method employed for this study which allowed the participants to narrate their physical and emotional experiences on graduation day and wearing the graduation gown on that day.

Data collected was analysed using thematic analysis (TA). This was found to be a suitable method for this study as it is a commonly used method in qualitative studies. TA provides a six-step method that ensures that the collected data are thoroughly analysed to extract the truest reflection of what was communicated to the researcher by the study participant. Different software was employed in this TA process, namely, Taguette and Excel. Taguette was used in the initial stage of the data analysis to group initial codes from the participant responses and Excel was used for the rest of the analysis process where the actual codes were extracted, and ultimate themes were identified.

From the analysed data, designs of inclusive academic gowns were created ensuring that the identified needs of the user were catered for through use of User Centered Design.

1.8 Theoretical framework

Universal Design is the theoretical framework on which this study is based. The Universal Design Principles were used as a data analysis framework of this study shown in section 4.1 through to section 4.7. UD was defined by the Center for Universal Design in North Carolina as the "design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialised design" (Connell et al., 1997:281). This phrase means that when developing products, a holistic approach should be adopted in which all users are considered equal during the design phase and in the finished product. The

researcher observed the nature of the product of this study and the need for the inclusion of all users which led to the reasonable consideration of choosing Universal Design as the theoretical framework that is appropriate to apply in this research.

1.9 Delineation

This study will not cover assorted colours of the academic gown, only black colour will be done. It will not cover any embroidery nor prints. It will focus on the fit, shape, functionality, and comfort of the garment. This study will not source different fabrication, only mini-matt fabrication will be used for the academic gown prototypes. There will be no mass production of the product, this study finished at the iteration stages and mass production will be recommended for follow-up research.

The practical part of this study was done in Cape Town, South Africa with the participants geographically based all over South Africa for one-on-one online interviews. Five mobility-impaired participants participated in the study. The data collected was used to develop an inclusive academic gown design. Detailed limitations of this study are outlined in Chapter 3.

1.10 Structure of the study

Chapter 1 introduces and outlines the study and its purpose. The study's objectives and a brief introduction are presented in chapter one. This chapter presents the problem of the academic gown's lack of inclusion, namely its failure to consider the needs of all users, including those with mobility impairments who make up the student body at South African higher education institutions.

Chapter 2 reviews the literature on the state of higher education in South Africa, inclusivity in institutions of higher learning, defining differently abled persons and the need for an inclusive design approach.

Chapter 3 outlines the research methods and design of this study. Further discussion of Universal Design Principles and User-Centred Design is covered in this chapter. The sample group and the research methodologies used in this study are also covered in this chapter. Chapter three briefly discusses limitations and ethical considerations as well as a sneak preview of the data analysis.

In Chapter 4, the reader will be guided step-by-step through the data analysis process. Here the reader will be shown the detailed design process with pictures of all sketches and fitting sessions with the participants including the photo shoot of the final garment.

Chapter 5 presents the findings, conclusions, and suggestions from this study for future research.

Chapter 2 : Literature Review

2.1 Introduction

This chapter explores literature on the state of higher education in South Africa and inclusivity of differently abled people in institutions of higher learning. Thereafter, terms used to describe differently abled people were also explored. Since differently abled is the term used in this study, the author will motivate the use of this term and examine the various viewpoints presented in journals about terminology for persons with disabilities. The writers' perspectives on the topic of the terminology used when referring to differently abled persons, as well as the participants' views, will be expressed in this chapter.

This literature review was compiled using several databases, including Berg Fashion Library, Ebsco host, Google Scholar, Scopus, and Web of Science. The Berg Fashion Library contained the fewest current studies about Universal Design and Universal Design concerning fashion, of all the databases. The information gathered was diverse, and it came in the form of journals and book chapters.

2.2 State of higher education in South Africa

At the beginning of 2015, South Africa saw a new era of student protest as students demanded decolonised free education and inclusion at institutions of higher learning. These protests happened countrywide forcing teaching and learning to come to a stand-still, this is the time when the #Fees-Must-Fall movement started (Ludski, 2015). At the same, a symbolic fall of colonialism happened when the council of the University of Cape Town voted for the eradication of the statue of Cecil John Rhodes on the 9th of April 2015 (Rhodes Must Fall, 2015). This act and the removal of the statue gave students hope to press on with their demand of decolonising the higher education system and inclusion in different areas. In 2012 Mngxitama read Steve Biko's view about community development initiatives that are a failure if development is done outside of total liberation from structures that produce suffering (Mngxitama, 2012). The above statement is applicable in the case of differently abled persons as the question of the origin of the current academic dress, its relevance coupled with the practicality remains an important one.

Recently, Reinoso (2018) questioned the obligation of wearing the prescribed academic dress on graduation day in Africa currently. As South Africa is busy transforming and decolonising the education system, graduation should not be left out of this process. Why would an important event such as graduation day in the life of a university student's career be still surrounded by colonialism symbols? This very same design and tradition were imposed by the British during

the colonisation centuries ago. To this day, Africans do not have a dress code that expresses their Africanism to celebrate their achievements in these prestigious events.

A similar question was asked by participant 1 of this study, why do graduands have to be confined to wearing an attire that has no resemblance nor identity or even a symbol of their Africanism, an attire that has everything to do with the dark past of colonisation of Africa by Europe? Likewise, the researcher here questions why differently abled persons must be obligated to wear a garment that may not meet their physical needs, for them to participate in their graduation day. This speaks directly to the subject of inclusivity of differently abled persons in the institutions of higher learning.

2.3 Inclusivity in institutions of higher learning

The current understanding of the differently abled term goes beyond the classification of the physical and medical condition of individuals, it is more of a human rights issue that considers the social and political context of differently abled persons (WHO, 2020). In Europe countries that are part of the European Union (EU) adopted a human rights perspective policy (European Union, 2013) that seeks to affirm differently abled persons' full participation in society, including education. Although European education is shifting towards being more inclusive to differently abled, the success and implementation still lie with each institution of higher learning (Biewer et al., 2015).

Differently abled people form part of the community and ought to be treated equally with dignity like all people. While much progress is made to include differently abled persons in higher education, there is still a long way to go, and this will be an ongoing effort that society should be conscious of for generations to come. Recent research shows that wheelchair users for example, still have a challenge of inaccessible buildings in some universities in South Africa (Chiwandire & Vincent, 2017).

In another journal written by four Scandinavian differently abled academics, it states that to this day not enough is done to include differently abled persons in the institutions of higher learning, with so many policies that are designed for inclusion. Those policies are also written by people with able bodies, who have no idea of the experiences of differently abled persons. This unfortunately causes differently abled persons not to enjoy the inclusion they should experience (Olsen et al., 2020). The focus of the next chapter will be on the methodology of this research and how the inclusion of differently abled persons in the design of the inclusive academic gown can assist, in addressing their needs. To effectively address the user's requirements, one needs

to understand who the user is and unpacking the term used in this study will assist in gaining an understanding of differently abled persons.

2.4 Defining differently abled persons

In defining differently abled persons, the idea of putting the person first, thereafter the disability is what the American Psychological Association (APA) encourages when referring to individuals with disabilities. The use of the term 'differently abled' rather than the use of the term disabled person/ people (Dunn & Andrews, 2015). This is done to encourage a culture of dignity when writing about differently abled people (Dunn & Andrews, 2015). This study uses the term: differently abled. It takes the idea of putting the person first a step further, in that, the emphasis is not on the disability of the person, but on the ability of the person. According to Suharto et al. (2016) this term presents a positive attribute of people with disabilities and reminds people about the value of emphasising abilities and acknowledging differences. In recent times, the use of the term disabled/disability which speaks to being differently abled is also emerging (Suharto et al., 2016).

The use of appropriate terms is necessary when writing about differently abled persons as one needs to be careful not to perpetuate negative stereotypes by using offensive words. Harpur (2012:1) states that persons with disabilities have endured discrimination and live under social apartheid. There remains a struggle to remove the negative stigma associated with this form of social diversity. Even nowadays continuous awareness of differently abled persons should be encouraged and recognised that they too are an equal part of the general community that should be treated with dignity. To contribute to this awareness, the author of this study took the conscious decision not to emphasise the impairments of persons with disabilities, but rather adopt the word 'differently abled' to highlight their abilities. It is important to note that, despite not opposing the phrase "differently abled persons," the study's participants preferred the term "disabled person" after being interviewed. They stated that rather than referring to or describing their impairment, this phrase reflects the environment that surrounds the person that disables them.

According to the International Classification of Functioning (ICF) by the World Health Organisation, the term "differently abled/ disabled is a collective term used for impairments, activity limitations, and participation restrictions" (WHO, 2018:1). Over a billion people are estimated to be living with a form of disability. This amounts to about 15% of the world's population. According to WHO, this number is expected to double by the year 2050. The number of differently abled people is growing because of the increase in chronic diseases and a global

ageing population. A higher presence of differently abled people is found in poorer countries, mainly because of the lack of access to health services and care (WHO, 2018:1).

In addition to this, the number of differently abled persons in higher education is growing. In recent times a higher number of differently abled persons enrol in institutions of higher learning than seen before (Hadjikakou & Hartas, 2008), this is seen because there is more attention paid to inclusion of differently abled persons in higher education that result to increase in enrolments. In South Africa, higher education is governed by several rules that state that increasing access to the participation of people with disabilities in higher education is recognised by law. (Department of Education, 1997; Department of Higher Education & Training, 2013). Despite this, there are still a remarkably small number of exchange students with disabilities both in South Africa and overseas (Fazekas, 2017). The inclusion of overseas students with disabilities in higher education in South Africa proceeds slowly since these students continue to confront obstacles like an inadequate understanding of their needs by significant role players (Du Toit, 2018). This chapter discusses a variety of issues related to accessible academic gowns for people with disabilities under the headings of Universal Design and inclusivity in fashion design.

2.5 The need for an inclusive design approach in fashion

Differently abled persons form part of general society. In the field of clothing design, there is a lack of inclusivity in clothing items. This lack presents challenges of fit for differently abled persons. These challenges ought to be addressed to promote inclusivity in clothing for differently abled persons. According to Arezes et al., designers need to understand the requirements of the users, to design and create products that address and please the genuine needs of end-users (Bragança et al., 2018). The statement above speaks to the success of the product, a product is successful when it addresses the needs of the end user.

Without the knowledge of what those needs are, it is not possible to please the end user. The product is the outcome of the design, the design process needs to include end-users. End-users will not design the product themselves, however, their requirements can be made known to the designer and this will be their contribution to the process, thus increasing the chances of success of the product. Ideally, all humans should have clothing items that fit them correctly with little or no fit challenges, in principle, any object worn by humans should be created to match the user's physical measurements (Ashdown, 2007). Consequently, if the dimensions are unknown, the product's success in meeting the needs of end-users cannot be assured and inclusivity is demoted.

The foundation of exclusion of differently abled people in clothing design is designed for general end-use. That includes academic dress, which is the subject of this study. Individual requirements of differently abled people are not considered in general body measurements, resulting in their exclusion from academic dress design and suitability thereafter. Every disability is different, meaning each person's body proportions and needs are varied. This must be thoroughly studied for the designer to be aware of the demands of differently abled people to create an inclusive academic dress. In the following statement, the authors explain a couple of crucial factors that are relevant to keep in mind and apply when designing clothing items, Clothing creates a barrier between people and their surroundings. People are protected by clothing layers, but they also add weight and heat stress. For this reason, the garment should be light in weight and comfortable. Garment silhouette should allow for a broad range of different motions to minimise the strain on the body (Reffeltrath, 2007).

Indeed, fashion designers should perceive the function of a garment on a person and thoroughly investigate a person's mobility when designing a garment, to reduce the strain that may be caused by an uncomfortable garment, both in silhouette and fabric. Wheelchair users in a study by Kabel et al. (2017) expressed that "...bulky coats do not close while seated and sleeves often get trapped in the wheels, they prevent proper use of crutches for those who use crutches" (Kabel et al., 2017:167). Incorrect garment fit may cause injuries to the wearer if the sleeves get trapped in the wheels and movement of a person using a wheelchair and crutches may be restricted.

In an interdisciplinary study done in 2016 by Falcão & Simões-Borgiani, the focus was on encouraging fashion students to design garments for, or with differently abled persons in mind. The purpose of this exercise was to instil this practice at the undergrad level, this practice may be continued even beyond studies in real-life practice. Including differently abled persons in fashion design is something that designers frequently forget to do and not practice, which leaves differently abled persons without support in the fashion industry. "As a result, people with disabilities use larger, most often not comfortable, clothes than their actual body size, without modelling or any adjustments, this constrains and affect their daily activates, and most importantly exclude them from fashion trends and standards" (Falcão & Simões-Borgiani, 2016:227). In other words, differently abled persons often end up purchasing and wearing uncomfortable and unflattering clothes without pleasing silhouettes and are often outsized.

The Fashion Design Degree, SENAC-PE College, Recife, Pernambuco, Brazil did this project as practice of training design students in thinking about the inclusion of differently abled persons when designing successfully in recent years, their approach is as follows; the first discussion

about designing for purpose of inclusion, this discussion happens with educators and students; then clustering of disabilities and addressing the specific characteristics and issues that may give challenges when wearing the garment this is done by identifying the body limitations caused by the disability; thirdly sketch different options of the inclusive garment and produce one inclusive garment that meets all the needs identified in the second step.

Students worked in teams for this project and a presentation in garment form was the final product where they gave a verbal presentation about their study and approach, as well as written output of the study, was submitted. Because this was an interdisciplinary project, different disciplines also followed the same process but applied it to their respective products (Falcão & Simões-Borgiani, 2016). Understanding the relationship and purpose between the human and the product was crucial to the project's success. In addition to creating a product tailored to the requirements of the human body, it was intended.

In a recent study by Ayachit and Thakur (2017) functional clothing for differently abled persons was intensively studied. They begin by describing the various bodily conditions, including the mental and physical disabilities that limit a person's ability to function normally in various spheres of life, such as movement and discernment. They argue that distinct types of disabilities call for diverse forms of functional clothing. "Disabilities are of many types and functional clothing for each type of disability has entirely different requirements. Persons who are wheelchair bound, those who are bedridden, persons who are spastic, autistic etc" (Ayachit & Thakur, 2017:904). They further state that while clothing for differently abled persons is meant to be functional, it should nevertheless maintain its aesthetically pleasant quality and fashion. "They should be easy to wear by themselves; they should be easy to care for and also provide the wearers with a sense of physical and mental comfort" (Ayachit & Thakur, 2017:904). Here, it is said that wearing clothing enhances the wearer's physical and mental health.

According to a study conducted in 2015 by Vianna and Quaresma on the ergonomics of clothing and body changes for elderly women, designers promote clothing for young people and fail to take the elderly community into account, whose physical body changes make it challenging for them to don and doff the general clothing assortment offered by retailers. These physical body changes may include bone stiffness, skin that thins and sags, weaker bones, and spine issues that limit elderly people's mobility. They continue to say that certain fabrics become rough to the skin as individuals age, and that trims, like zippers and buttons, are challenging to use (Vianna & Quaresma, 2015). Differently abled persons have similar experiences with their bodies and therefore require the same attention with clothing items.

The study of Parks et al. (2014) also discusses a few current design models that have a connection with UD. These are slow design, co-design, sustainable design and product personalisation. The design model that is of interest to this study is product personalisation. Product personalisation is expressed as a process that changes the functionality, boundaries, information content or distinctiveness of a product to increase its relevance to an individual (Blom, 2000:313). This identification is significant to this study because it addresses the issue of including differently abled in the discussions about inclusive academic dress. Differently abled people have different disabilities, and it was discovered through conversations with participants of this study that; each disability is unique. As a result, product personalisation would be appropriate for graduands with disabilities whose needs would still not be met by the inclusive gown due to the uniqueness of their bodies. The next research towards inclusive academic gowns for people with disabilities is advised to consider this concept. It can be thoroughly investigated.

Afacan & Erbug, 2009 say “usability and accessibility should be part of the design thinking process, and no stigma traces should be discovered in the design, for UD and UDP to be successfully used in a product or the space design. This will enable the social inclusion of all users. (Afacan & Erbug, 2009:731).” When there is a lack of understanding of how to incorporate UD into building structures or designs, as well as a lack of communication between the designer and construction personnel, the space is likely to end up being incorrect, which can be costly to correct later, as the discovery is often made after the building is completed. (Afacan & Erbug, 2009) Fast forward to 2021, when a compatibility study was done by the Department of Architecture, Faculty of Engineering, Aswan University in Aswan, Egypt by Khalil, Mohamed and Morghany. This study was titled, Towards inclusion and diversity in the light of Universal Design: three administrative buildings in Aswan city as case studies. In this study, a case study method was employed to compare three buildings in search of usability and application of UD and UDP in these buildings. The seven UDPs alongside six elements concerning accessing and using buildings were used as a measuring stick. Enjoying circulation systems, entering and exiting, wayfinding, parking and passenger loading zones, getting goods and services, and using public amenities were the six components. Three fundamental components are concentrated on out of these six factors specifically to compare these, namely: Using circulation systems; mechanical circulation system, elevators, ramps, stairs, hallways, and corridors. Entering and exiting; identify the entrance and exit and move through them, departing the entrance and exit areas. Wayfinding; paths/circulation, information system design, sign content, and orientation aids” (Khalil et al., 2021:5). After examining the three buildings based on UD, UDPs and the three basic elements described above, it was discovered that these buildings did not properly meet the UD and UDP standards. It was found that user feedback

was more accurate, and suggestions were made for prospective adjustments to ensure that everyone was included and that everyone's usability was enhanced (Khalil et al. 2021).

Likewise, in the design of schoolyards, the inclusion of all must be present. In Turkey, authors Sensoy and Sari (2016) embarked on a study on the suitability of the schoolyard for children of all abilities. Their view was that for children, most learning happens through play and the schoolyard is one of the most important spaces - playing a significant role in the growth of a child mentally, physically, emotionally and socially. In childhood, we form deep attachments to the location in which we grew up and carry the image of this place with us for the remainder of our lives (Sensoy & Sari, 2016:444). The unpleasant truth today is that children play less and are restricted from free play due to unsafe urban environments. The authors further state that if a play area is created to meet the requirements of all users, irrespective of their capabilities or limitations, great outcomes can be obtained. Accessibility, safety, and functionality are just a few of the benefits that a well-designed facility should provide (Sensoy & Sari, 2016). To make the design practicable, the site had to be examined in collaboration with the demands of the users, both teachers and pupils.

These needs were discussed, analysed, and incorporated into the final design as well as UDP. Sensoy and Sari (2016) discovered that including the user, in this case, the teachers and pupils is a vital aspect of design. To ensure that all users' requirements are satisfied, and to promote a sense of belonging to the school, reducing the risk of vandalism, and enhancing everyone's responsibility for the property, physical and emotional impact the following statement encapsulates and gives meaning to the discussion in the previous paragraph, Wang et al. (2014) express that it is both meaningful and useful to design clothes for disabled people that fit both their physical and psychological needs. Clothing designs should be user-oriented to meet the needs of end consumers. It should provide a sense of security and comfort, as well as values such as self-esteem, respectability, and prestige (Wang et al., 2014:550-551). The values discussed above, link with the emotional needs of the graduates and are relevant whether one is differently abled or not. These authors not only discuss physical needs that must be catered for in a garment, but they also discuss emotional needs that may be fulfilled by a carefully considered design. This is both interesting and important to note, as humans need to have satisfaction in both emotional and physical as well as other areas of life.

2.6 Theoretical framework

The theoretical framework of this study is Universal Design wherein the Universal Design Principles were used as a data analysis framework, see chapter four for elaboration. UD was defined by the Center for Universal Design in North Carolina as the design of products and environments to be usable by all people, to the greatest extent possible, without the need for

adaptation or specialised design (Connell et al., 1997:281). The above statement implies that a consistent approach should be used when creating products, wherein all users are treated equally and considered during the design stage and afterwards in the final product. Though there were other design approaches discussed in table 1.1 the researcher observed the nature of the product for this study and the need for the inclusion of all users which led to the reasonable consideration of choosing Universal Design as the design approach to apply this research. By virtue of UD being a design approach that seeks to satisfy all users both in design and final product of items UD, is the approach of choice in this study.

Chapter 3 : **Research Methods**

3.1 Introduction

The theoretical foundation of this study was outlined at the end of the preceding chapter. The main concept on which this study was founded is Universal Design. This chapter examines both Universal Design and User-Centred Design as well as Data analysis and the prototyping process. An explanation of the seven Universal Design Principles (UDPs), including how they were used in this study, is provided. The User-Centred Design approach and its application in this study is covered in section 3.6.2.

It is important to keep in mind the primary and sub-questions of this study as well as the aim and objectives of this research to understand how the methodology action of this study aligns with the research question.

3.2 Research questions

3.2.1 Primary research question

PRQ: How can UDPs be adopted for the design of inclusive academic dress for differently abled persons?

3.2.2 Research sub-questions

The two RSQs are:

RSQ 1: How do differently abled persons experience the wearing of conventional academic dress?

RSQ 2: To what extent can the application of UD be applied to the design of academic dress contribute to an improved graduation experience?

3.3 Research aim

The primary aim of this research was to develop a suitable and inclusive academic dress design for differently abled persons, in particular a gown, as well as contributing to the best practices for inclusivity in the institutions of higher learning in South Africa and the field of fashion, specifically the academic dress.

3.4 Objectives

To identify the core issues linked to the academic gown fit and behaviour using one-on-one interviews as well as understand the physical and emotional experience of donning the conventional academic gown for differently abled participants, the objectives are as follows:

- To allow the findings from the one-on-one interviews to guide the design process to address the issue of inclusivity of the academic gown.
- To design an academic gown suitable for differently abled graduands, informed by feedback from research participants.

3.5 Research design and methodology

3.5.1 Research philosophy: Interpretivism

This study positions itself to an interpretivism approach described by Elster (2007) as the approach that strongly emphasises how important it is for individuals to be themselves and engage in cultural and social life. The researcher agrees with this philosophy, as it forms the basis of this study. When differently abled persons who are participants of this study were interviewed, it was important to allow them to be themselves and for them to share their graduation day experiences honestly, and not interfere with the shared data. Kaplan and Maxwell (1994) expressed that interpretivism is an endorsement of qualitative data in the search for knowledge (Myers, 2017). This is especially true for this study as the researcher was able to appreciate the needs of the participants, who are representatives of the greater population of people with disabilities enrolled in institutions of higher learning. However, some writers argue that while interpretive research adds context to a study, critiques frequently cast doubt on the objectivity and legitimacy of its conclusions (Perry, 1998).

Nevertheless, it is appropriate to end this discussion with words from Gadamer, expressing that being aware is being aware differently, always (Chowdhury, 2014). Simply put, knowledge is a basic aspect of a person's individual experience of life rather than a single action performed by humans. Fundamentally, it is important to comprehend how people perceive life and interpretivism as a philosophical ideology that aids in this cause.

3.5.2 Qualitative research

This study assesses whether adopting UDPs could result in an academic dress that is inclusive of the community of people with disabilities. It also sought to improve the wearer's experience by redesigning the conventional academic gown to better suit the wearer's requirements. To effectively build an acceptable and inclusive academic gown for differently abled persons, it was critical to obtain insight into the current experience of donning the traditional graduation gown.

A qualitative approach was used in this study, as it deals with the experiences of people, and helped the researcher to understand what is significant to the study's sample group, namely the differently abled community (Silverman, 2016). Qualitative research gives attention to the individual and inimitable experiences of the participants (Billups, 2019). Assistance was requested from the disability unit at an institution of higher learning to reach differently abled

alumni who were enthusiastic about taking part in the study. Further to that, the individuals assisted in approaching other differently abled persons known to them for this study. This was the snowball sampling effect that took place as described by Kirchherr and Charles (2018) when an interviewee offers the researcher the name of at least one other interviewee. This interviewee then provides the contact of at least one further respondent, with the sample growing exponentially if each interviewed makes more than one referral (Kirchherr & Charles, 2018).

This study is Practice-based research. PBR is often applied within the field of design. A study by Stevens (1966), of an electrical control mechanism for an artificial limb, recorded the first design-related PhD around engineering design. Later more studies emerged in design, such as that of Cunniffe (1975), on how ergonomics is used in wheelchair design (Yee, 2010). These instances of practical research around typeface description concentrated on two key topics, namely: i) the practical examination of a challenging circumstance seen in the area; and ii) the study of a suitable approach situated within the researcher's studio practice (Dixon, 2001). In this case study, a method called design as research was used. The method encompassed reflective practice and the artefact produced was a CD-ROM. The study's research findings were divided into two categories: the first concerned the study's subject matter and the second dealt with the methodology of a practice-based inquiry. (Yee, 2010).

Like the above-mentioned research project, this study followed a process where the research informed the artefact. Conversations with the participants helped to shape the practical approach and UDPs were used around inclusive academic dress for differently abled persons when reflecting on conversational individual interviews. This type of research is unconventional in that research is not often approached in this way in a South African institution of higher learning.

3.6 UDPs and UCD approach

3.6.1 UD in Fashion: History

As early as 1998 when Universal Design and its Principles were being applied in other areas of life Universal Design applications started to happen in fashion and fashion products as well (Carroll and Gross, 2010; Carroll and Kincade, 2007; Martins and Martins, 2012) were the few that have applied the concept of UD in fashion (Park et al, 2014:269). The application of the seven principles of UD as suggested by the Center for Universal Design of the School of Design at the State University of North Carolina, USA (Story et al., 1998), UDP acted as recommendations that provided direction while producing inclusive fashion goods and apparel. To guarantee that everyone was represented in their designs for the garment sector, designers started implementing the UDP. Unfortunately, not all designers adopted the inclusion and

included it in their designs, therefore people with disabilities still have difficulty finding clothes that fit their needs.

A person's ability or disability should not prevent them from enjoying the item they purchase; the product should be designed such that all consumers may enjoy it. Regardless of their socioeconomic rank or ability, everyone has dreams, ambitions, and needs. Apart from needs resulting from their crucial disabilities, the needs of people with disabilities are the same as those of users without special needs in terms of aspirations, individuality, values, and status. Martins and Martins (2012:4734) state that "designing a fashion product that is more accessible to groups of people with and/or without special needs, is to ensure user satisfaction, regardless of their physical and cognitive states".

The user's needs must be communicated to the designer for them to be included in the design process and for the user's demands to be addressed through fashion goods. Therefore, users ought to be involved from the beginning of a product's design and development. The designers will be able to use UDP efficiently as they gain a better understanding of the user's requirements. Combining ergonomics with design aims to provide apparel and accessories that satisfy the demands of their customers in terms of comfort, mobility, and utility (Martins & Martins, 2012). The focus of this study is comfort, mobility, and usability; these factors made this research necessary. This topic will be visited and discussed later when the gap is defined, and the academic dress is discussed.

Martins, further states in 2008 that UD is an approach toward design that makes no exceptions, that it purposefully includes all users in the product by considering that people have different abilities and limitations (Martins, 2008). The author also explains that, while people can be involved in product design, this does not necessarily imply that all products designed would be used by everyone equally.

As a result, the application of UD as well as the principles and practical solutions becomes critical. It is concerned with specific solutions that are appropriate for the product. Designing clothing items using UD and its principles, on the other hand, is not an easy task because there is a lot to consider, especially given the complex nature of fashion items. When commencing on UD in fashion, it is critical to pay close attention to detail, and understanding the users' abilities and limitations will contribute to the design's success (Martins & Martins, 2012).

In another study by Park et al. (2014), the use of UD and its principles in fashion was examined. They investigated how UD may be used as a guide to aid in the inclusion of all people. According to their research, UD gives structure for the fashion design process to be successful in

developing flexible products. However, owing to the intimate proximity of the product to the wearer and the nature of clothing items usually worn directly on the body, adaptations to the basic UD principles must be addressed for clothes (Park et al., 2014:268). Depending on the item being designed, these adjustments will vary, and designers may choose to adopt all or some of the UDP to evaluate their products.

According to another study, designers need to provide more precise guidelines to further simplify the UD concept (Steinfeld & Maisel, 2012). In a study done by Park et al. (2014), they noted that designers made little or no attempt to apply the UD and UDP theories, to accommodate most consumers and their requirements in fashion products (Park et al., 2014). This means there is still a long way to go to ensure the inclusion of all in the fashion industry. Their study (Park et al., 2014) reflects on the agreement made by different researchers who studied the product development process in clothing design.

According to Park et al, in 2014, the following is the outline process that should be followed when designing garments to satisfy the end user's needs:

- i) **Needs assessment research** should be done. This is the most important stage of this process as it initiates the process. The designer should take time to understand the needs of the end user before embarking on the design process. In this study, the researcher spoke with the end-users to learn about their needs where the academic gown is concerned. This process helped with identifying the exact requirements of the end user in this garment.
- ii) **Creative exploration:** After finding out what the needs of the end users are, the designer can apply his/ her creative knowledge aligning the needs and the product. This is done by sketching the possible ideas that can become the product that is sampled and assessed by the end-user in the next stages. In this research, the information given by end users informed the design sketched by the researcher.
- iii) **Prototyping:** This is when the sketch comes to life in product form. In this research the prototyping was done first by creating a two-dimensional pattern on paper, thereafter the different pattern pieces were laid on top of the fabric, traced and cut out. The different panels were then sewn into a garment.
- iv) **Design evaluation and confirmation:** This is when the product is taken back to the end user to assess if the product meets their needs as discussed in the first step called needs assessment research. In this stage, the end-user is welcome to give feedback to the designer about the prototype. The end-user indeed did give feedback about the prototype in this research as well (Park et al., 2014: 272-273).

The feedback is good as it informs the designer where the necessary corrections are needed to improve the product. After the prototype and feedback, there will be a need to do more prototypes to refine the design so that it aligns with the requirements of the user. The number of prototypes needed depends on the simplicity or complexity of the design (Park et al., 2014). A similar approach was followed in this study, this approach is detailed in diagram form at the beginning of Chapter 4.

In this study, two rounds of iterations were done. The first was the initial prototype after the needs assessment and the second round of prototyping was informed by the user feedback when they fitted the prototype. For the second evaluation, a photo shoot was organised where two models who are potential end users of the product were fitted and photographed see pictures included in Chapter 4. The end users' feedback about the product is important because they are the people for whom the product is created, the success and failure of the product depend on them.

There is an interesting difference that was discovered through reading about what researchers express, understand, and advise, regarding UD. Carrol and Gross (2010) had an opinion of creating groups of users with similar physical disabilities and concentrating on them when designing rather than applying UD for all. Their design process is like the five steps in the earlier paragraphs. However, they zoom in on the third stage and use UD as a dipstick to assess if the needs of the user are catered for. However, the view of Park et al. (2014) is different, in that they believe that UD and its principles can be applied throughout the design process.

It was discovered that consumers grow attached to their items after using them in their daily lives; they see them as an extension of their identity that others may identify. Apparel must conform to a person's physical individuality imposed by age, weight, gender, body shape and life stage while also meeting practical needs for protection from the environment (Park et al., 2014). In other words, fashion products should protect people while still meeting their needs in terms of silhouette, size, and lifestyle.

People dress in a way that suits their personality, needs, and service. A person with a cheerful personality, for example, might easily dress in bright and strong colours and prints, whilst a reserved person may want to dress in more neutral colours that will not bring attention to them. A person living at the north pole, where the weather is bitterly cold, will need to dress warmly and protect themselves from the weather. When police officer or a nurse is on duty, they wear uniforms to be distinguished by others and to give them the authority to carry out their duties. Graduands are identified by wearing an academic dress on their graduation day in the context of this study.

Each of the seven UDPs was applied in this study to identify and address the difficulties faced by differently abled users when donning the conventional academic gown. The paragraphs that follow in this section give a quick explanation of this process. The approach of using the UDP in codes is thoroughly discussed in Chapter 4.

These principles have been used in apparel in some areas of the world, with designers introducing elements that seek to include differently abled people in the design of their products. With a focus on people with physical limitations, researchers (Park et al., 2014; Martins & Martins, 2012) researched all the seven principles and discovered locations in clothes where they may be implemented. Their apparel interpretation included the following considerations:

Martins and Martin's (2012) theory regarding UDP states that "UDP seeks to extend inclusion of users in the design process and to ensure that their needs are met from the beginning" (Martins & Martins, 2012:4733). This is precisely what this study aims to ensure. Universal Design seeks to include users in all products and has been used successfully in fashion products. For example, smart clothing was created by British researchers with inspiration from bionics, a field of study that aims to translate natural phenomena into artificially created goods (Martins & Martins, 2012:3). Microtechnology is used to create a material for smart garments that releases air when it gets cold and lets air in when it gets hot. The process is like how coniferous trees split and release their seeds, as well as how performance materials work, particularly when it comes to enhancing aerobic athletics by employing fabrics that enable perspiration to escape swiftly and dry (Martins & Martins, 2012:3).

Another example is a zipper tag embedded in a pocket to prevent skin abrasion between the skin and the plastic or metal material of the fastening system of this trimming. A zipper with an anthropomorphic tag for easy handling. Adjustment devices using adjustable elastic used in baby clothes can also be used in clothing for the elderly and the obese (Martins & Martins, 2012:3).

The use of UDPs in product development ensures ease of use for all users. This frames the project and the decisions taken in the methodology and product development. In the process of designing an inclusive academic gown, the users' needs were observed by using the UDP as a guide in the following ways:

- *Equitable use*: Ensure that the academic dress, particularly the academic gown is useful to its differently abled users. The garment fit and comfort areas were addressed.

- *Flexible in use:* Ensure the inclusive academic gown accommodates a wide range of differently abled users regardless of their disability. There is a choice within the academic gown range to suit diverse needs.
- *Simple and intuitive:* Understanding the academic gown is simple., and the user can don and doff without experiencing style complications - this speaks to the functionality of the garment, which was ensured in the pattern and design stage.
- *Perceptible information:* The design does not necessarily look different from the normal range to give a discriminative perception towards differently abled users, see photoshoot pictures of inclusive academic dress in Chapter 4, section 4.7.
- *Tolerance for error:* Ensure that the design does not put the user at risk of accident, minimise all hazards on the inclusive design – ensure that there is no unnecessary fabric volume in the design that may be caught up on wheels for wheelchair users, or tripped over when walking (see photoshoot pictures in the conventional academic dress included in section 4.7.)
- *Low physical effort:* The design is practical, comfortable, and requires minimal physical effort to operate – easy to don and doff.
- *Size and space for approach and use:* Regardless of the user's size, posture, or mobility, make sure the design allows for optimal reach and movement (Clarkson et al., 2003).

Boundaries of ergonomics in design guide fashion product development, to ensure that the products produced benefit the users, in comfort, mobility, and usability (Martins & Martins, 2012). The above-listed benefits are important for all users including differently abled persons.

To make UD feasible in the design process, one needs to apply UDPs and guidelines. This is the next point of discussion in this chapter. The seven original UDPs were developed in the late 1990s by the Centre for Universal at North Carolina State University (Helvacioğlu & Karamanoğlu, 2012:201). These UDPs enable designers to focus on the product/ service and the user; they allow the user to be a part of the development process by requiring them to communicate their needs to the designer, who then offers an acceptable result based on the user's needs. Ron Mace was one of the pioneers of Universal Design.

Being a wheelchair user himself, Ron Mace, an educator, architect, and product designer was an advocate for and an ambassador of Universal Design. In the 1980s he was a leading proponent for UD and its Principles at the (Center for Universal Design in North Carolina). Under Maces' philosophy, all designs ought to be useable and accessible to everyone without the need to question each individual whether their design should be considered universal or conventional. regrettably, Mace passed away in 1998 (Clarkson et al., 2003:13).

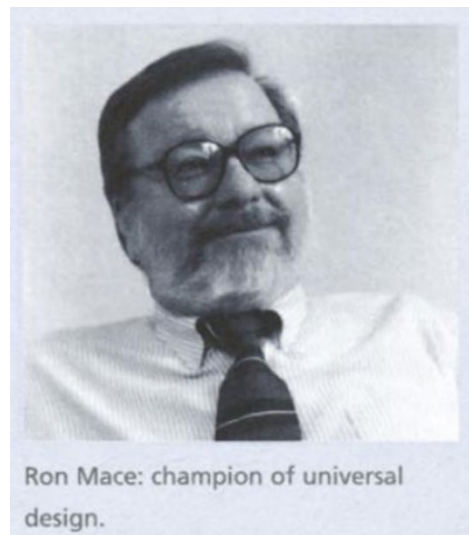


Figure 3.1: Ron Mace

(Source: Clarkson et al., 2003:13; <http://www.springer.co.uk>)

Most design thinking approaches are covered by UDPs, which guarantee that the demands of the users are considered in the finished product. Inclusivity for all users is made feasible in this way. To assess existing designs, guide the design process, and educate other designers and consumers about the advantages of incorporating Universal Design into their product development. Designers can use all or a portion of the UDP depending on the demands of the consumers (Helvacioğlu & Karamanoglu, 2012:201). The dedication of all designers will enable the inclusion of all people in designs.

Figure 3.2 presents the seven original UDPs.

- 1 Equitable use – the design is useful and marketable to people with diverse abilities.
- 2 Flexibility in use – the design accommodates a wide range of individual preferences and abilities.
- 3 Simple and intuitive to use – use of the design is easy to understand, regardless of the user's experience, knowledge, language skill or current concentration level.
- 4 Perceptible information – the design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
- 5 Tolerance for error – the design minimises hazards and the adverse consequences of accidental or unintended actions.
- 6 Low physical effort – the design can be used efficiently and effectively with a minimum of fatigue.
- 7 Size and space for approach and use – appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture or mobility.

Figure 3.2: Seven original UDPs

(Source: Clarkson et al., 2003:13; <http://www.springer.co.uk>)

Alongside the UDPs, guidelines were designed to assist designers in the implementation of UD in various areas of design. They provide a more detailed explanation of how to apply the UDPs in the actual design of the product. These provide practical solutions to design problems. The guidelines for apparel are as follows:

3.6.2 Guidelines

Table 3.1: UDPs and design solutions in apparel

(Source: Hamilton et al., 2014:270-271)

	<i>Design principles</i>	<i>Guidelines</i>	<i>Design solutions</i>
1	<p>Equitable use The design is useful and marketable to people with diverse abilities.</p>	<p>1a. Provide the same means of use for all users: identical whenever possible; equivalent when not. 1b. Avoid segregating or stigmatizing any users. 1c. Provisions for privacy, security, and safety should be equally available to all users. 1d. Make the design appealing to all users.</p>	Relaxed silhouette that fits a wide range of consumers of different sizes and shapes.
2	<p>Flexibility in use The design accommodates a wide range of individual preferences and abilities.</p>	<p>2a. Provide choice in methods of use. 2b. Accommodate right- or left-handed access and use. 2c. Facilitate the user's accuracy and precision. 2d. Provide adaptability to the user's pace.</p>	Versatile way of dressing.
3	<p>Simple and intuitive use Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.</p>	<p>3a. Eliminate unnecessary complexity. 3b. Be consistent with user expectations and intuition. 3c. Accommodate a wide range of literacy and language skills. 3d. Arrange information consistent with its importance. 3e. Provide effective prompting and feedback during and after task completion.</p>	Easy donning and doffing.
4	<p>Perceptible information The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.</p>	<p>4a. Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information. 4b. Provide adequate contrast between essential information and its surroundings. 4c. Maximize 'legibility' of essential information. 4d. Differentiate elements in ways that can be described (i.e. make it easy to give instructions or directions). 4e. Provide compatibility with a variety of techniques or devices used by people with sensory limitations.</p>	Easy to understand the dressing procedure. Simple yet thoughtful design. Minimal design details.

5	Tolerance for error The design minimizes hazards and the adverse consequences of accidental or unintended actions.	5a. Arrange elements to minimize hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated, or shielded. 5b. Provide warnings of hazards and errors. 5c. Provide fail safe features. 5d. Discourage unconscious action in tasks that require vigilance.	Design that does not hinder body movement. Optimized fit for size flexibility.
6	Low physical effort The design can be used efficiently and comfortably and with a minimum of fatigue.	6a. Allow user to maintain a neutral body position. 6b. Use reasonable operating forces. 6c. Minimize repetitive actions. 6d. Minimize sustained physical effort.	Easy donning and doffing and easy maintenance.
7	Size and space for approach and use Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.	7a. Provide a clear line of sight to important elements for any seated or standing user. 7b. Make reach to all components comfortable for any seated or standing user. 7c. Accommodate variations in hand and grip size. 7d. Provide adequate space for the use of assistive devices or personal assistance.	Flexible size and fit. Easy donning and doffing.

Table 3.1 above shows how a designer should think while creating products or spaces, as well as what should be included in the thought process to ensure that all users are taken into consideration. The guidelines can be used as checkpoints by designers to check that the product's full potential is delivered and available to users when it is in use. With the above information in mind, now is a suitable time to look at how UD was used in different areas of life to ensure the inclusivity of all users. The following general areas will be briefly discussed. architecture, interior design, and street design.

3.6.3 User-centred design

A User-Centred Design approach seeks user feedback at all stages of the design and products are based on a thorough awareness of the user's demands and the context of use and go through a product sampling process. A crucial component of User-Centred Design is prototyping. The design process can be improved and informed via prototyping. A prototype that people may start testing can be used to represent design hypotheses based on user insights. Without the user's active involvement, the design cannot be improved.

Depending on user comments on which features are useful and which are not, the design may be improved. To make sure new items satisfy users' needs, the UCD places a strong emphasis on active collaboration between users and designers. Including end users in the development process, as opposed to continuing to design for users, is what is meant by the change from

designing for users to designing with users. Instead of designers joining the users' working environment, this activity is defined as bringing end-users into the development environment.

According to a study by Naesgaard et al. (2017), User-Centred Design was an efficient way to address the challenge of creating appropriate work attire in extremely cold temperatures. User involvement was generally given little consideration in previous design creation procedures. In this way, gathering information about users was limited to soliciting feedback from them or worker delegates. It was discovered that a lack of user insight was the main reason why products failed, whereas involving users in the design process increased the acceptability and enjoyment of the final product. End-users are specialists in the specifics of their work environment, so they can anticipate issues associated with the introduction of new garment solutions (Naesgaard et al., 2017). Similarly, the end user's full engagement was required in the design of an inclusive academic gown in this study.

To find out about the users' needs for an inclusive academic gown as well as their concerns and limits with the conventional academic gown, the researcher conducted individual interviews with the users. The information gained from interviews informed the design and a prototype that was made. The inclusive gown prototype was fitted with the user, and their input was documented during the fitting session. Once more, the user was involved in the ongoing development of the prototype, offering feedback on the garment's fit, and feel, and other recommendations for adjustments to be made in the inclusive design for those with disabilities who would wear the gown. The Inclusive Design needed to be improved for differently abled persons to use it. Figure 3.3 shows how the UCD approach was used in this study.

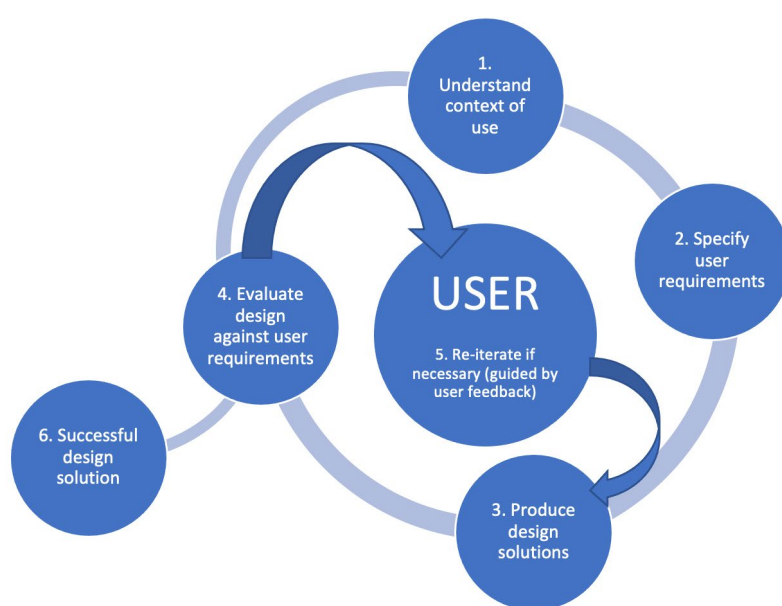


Figure 3.3: The User-Centred Design approach (adapted from ISO, 2010)

The UCD approach phases seen in Figure 3.3 are unpacked below:

Phase 1: Understand the context of the use

In this phase, the problem is identified, and then research questions are created. One-on-one interviews were used to gather user requirements for a usable and inclusive finished product.

Phase 2: Specify user requirement

The information acquired was subsequently evaluated using the thematic analysis method. During the analysis procedure, the issues with the conventional academic gown were discovered and fixed.

Phase 3: Produce design solutions

The UDP and UCD serve as a guide for the design process, following the data analysis phase, after which inclusive design sketches and samples were produced. After being fitted with a sample, the user was asked to comment on how the inclusive academic gown fit and felt.

Phase 4: Evaluate the design against user requirement

To determine if the user needs were considered in the inclusive design, the fitting session and the feedback were assessed against the UDP as per sections 3.3 and UCD in section 3.3.1.

Phase 5: User

The user was the focal point of the entire process. Depending on the user feedback, the iteration step would need to be repeated to address any issues that arose with the inclusive design during the fitting process. In the initial iteration of this study, the user mentioned a few minor fit issues with the inclusive garment; for more details, see sections 4.4 and 4.6 in the following chapter, Fit and Feedback. A final garment was created after the suggested changes.

Phase 6: Successful design solution

The final designs were created as the proposed design solution for the inclusive academic gown for differently abled persons.

Table 3.2: Participant identity and credentials

(Source: Researcher)

Participant	Age	Gender	Disability	Education	Year graduated
P1	Unknown Unspecified (in the mid-40s)	Male	Mobility impaired on a wheelchair, with the use of one hand	Several degrees including two Masters	1999. Also currently studying

P2	44	Male	Mobility impaired, use of crutches	BCom in Communication	Early 2000s
P3	43	Male	Paralysed from neck down, on a wheelchair	BTech: Public Management	2005
P4	53	Female	Incomplete quadriplegic in a wheelchair	BAdmin, BCom Honours in Industrial Psychology	1997, 1998
P5	32	Male	Corrected clap foot, mobility disability on the left foot	BTech: Civil Engineering, and currently enrolled as a master's student	2016, 2017

3.7 Sample group

The sample group for the study consisted of a total of five participants. Connecting the researcher with willing participants required the use of both the snowball approach and the disabilities unit. Participants come from a range of demographic groups and have different degrees of mobility limitation. This sample population includes people who use both manual and electric wheelchairs, as well as someone who can walk unassisted with a corrected clap foot and someone who relies on crutches.

All five graduands who took part in the study did one-on-one online interviews for information gathering and discussing their experiences with the conventional academic dress, notably the academic gown. These online interviews were conducted to find out what the graduands thought of their gowns after they had all graduated. One female and four male volunteers made up the sample group. All who took part did so voluntarily.

Each participant was allocated a code, which for this study's purposes is designated as "P" for participant followed by an allocated number, namely P1, P2, P3, P4, or P5. This allowed for anonymity and aimed to facilitate the freedom, to be honest without being identified. Geographically, the participants were located throughout South Africa. P1 is a middle-aged male from Pretoria. While P2, a 44-year-old male, P3 – a male aged 43 years, and P5, a 32-year-old male, were all based in Cape Town. Finally, P4 is a 53-year-old woman from Johannesburg.

3.8 Interviews

The interview process was done in a semi-formal and relaxed manner, with participants free to answer and elaborate on the questions asked. To get qualitative data from people's responses to open-ended questions, personal interviews are frequently used. (Kvale, 1996; Patton, 1990). All interviews were performed online to promote social distancing during the Covid-19 outbreak

and to overcome the geographical challenge of the interviewer and participants being in separate cities in South Africa. Using the online communication platforms Microsoft Teams and Zoom, a total of five semi-formal one-on-one interviews with the participants were carried out. All interviews were recorded on video.

While the researcher conducted the interviews from the privacy of her home, the participants chose their settings to assure privacy, including residences, offices, and even cars where they could speak freely and without interruptions. From the first interview to the last, the process took about one month. The participants' schedules were taken into consideration when scheduling the interview time. Some interviews took place during the week and business hours, while others happened on the weekends and after work. Depending on the length of the conversation with the participants, the interviews ranged in length from thirty minutes to an hour and fifty minutes. Participant consent was sought before the interviews. All participants who took part in this study participated voluntarily.

The purpose of these interviews was to collect data from the participants. Participants informed the researcher about their experience as differently abled graduands when they wore the current offering of academic dress. The experiences shared were both linked to physical and emotional aspects. This information informed the design of an inclusive academic gown design that is more user centred. Online interviews help to save time because there is no need to travel to a specific interview location and participants can be stationed wherever they feel most comfortable throughout the interview.

While keeping in mind the deadlines for the research, the interviewer was flexible about schedule modifications as necessary (Bryman, 2012). This technique helped to open the interview session and make everyone feel at ease. The participants were also informed that their names would be kept anonymous, except for those who took part in fitting sessions and photo shoots and gave consent for their images to be used in this study. Keeping everyone informed about the study's goal and purpose also contributed to a safe environment. Throughout the interview sessions, the interviewer made sure to uphold the participants' respect and decency.

The participants received the interview questions in advance so they could be ready for the interview. Sessions were informal, inviting participants to openly discuss their opinions of the conventional academic dress as well as their needs and wants in this area. The researcher drew inspiration from the graduation day experiences of differently abled persons, paying particular attention to the process and experience of donning and doffing the academic gown as well as their requirements for the ideal academic gown design that will ensure inclusivity. This data was

analysed by applying the creative and cognitive analytic processes, and the UDPs were then employed in the construction of an appropriate academic gown design for differently abled persons.

The following are the questions that were used as a guide for the interview sessions:

- What was your experience with the academic dress, the gown in particular?
- Would you be open to the idea of a specific academic dress for differently abled persons?
- What specific features would you like to see in the academic dress?

3.9 Limitations

It was helpful that the Disability Unit assisted with potential participant names and contact information for five willing participants. All potential participants were telephonically contacted. Thereafter consent forms were sent via email to individual participants in the group with a brief description of the study. The initial response was one of eagerness and availability for a virtual meeting, but none responded to the email correspondence. Additional calls and emails were placed to acquire set interview dates. Unfortunately, this too proved unfruitful in securing interviews. Furthermore, one participant set interview times but ended up cancelling twice. No further attempts were made to engage this participant after the second cancellation. This was in line with the ethical considerations when engaging the participants.

Finding a recently graduated, differently abled person to attend their graduation ceremony has also proven to be significantly difficult. First, the last time face-to-face graduation ceremonies were attended was almost two years ago due to the restrictions of the Covid-19 pandemic. During this period, graduation ceremonies moved to online graduations or “smart graduations,” in which photos of the graduands are sent and the ceremonies are pre-recorded and viewed online at a specific time. Thus, there was no need to wear an academic gown.

The interviews had to be conducted individually because the participants who consented to participate in the study were not all available on the same day for a focus group. Other participants expressed that they did not feel comfortable discussing their private experiences in front of other participants.

Another disadvantage of the study was that only one participant with a single type of mobility impairment was used to test the redesigned gown (first iteration).

Finally, the geographical location of the participants was also a limitation as the researcher drove to the other side of Cape town and was not able to fit the second iteration with the male

participant as planned, he was also not available on his phone, so the fitting session was abandoned.

3.10 Ethics

This study involved people with mobility impairments who are differently abled, thus it was crucial to keep proper ethical guidelines in mind, both during individual interviews and later when analysing and processing the data. It was the responsibility of the researcher to ensure that the rights of the participants were continuously preserved and respected. The identity of the participants is protected by coding them as P1, P2, P3 and P4, then storing this coded list with corresponding names on a password-protected computer that only the researcher has access to. Data will be kept safe for five (5) years post the completion date of the study as this is the standard procedure required by the university.

To uphold ethics when conducting research involving people with disabilities, reading up about the subject had to be done. The details of how ethics were upheld in this study are covered in the following paragraphs. Wiles et al. (2004) note the following issues to be mindful of when researching differently abled persons:

1. To be mindful of the needs of the participants, for example, conduct the interviews at the time when the participant is available and to be flexible to allow for a break if it is needed.
2. Ensuring continual agreement and consent.
3. Handling relationships that develop during the research process.
4. Anticipated, distressing emotions.
5. Surprising disclosures

Figure 3.4: Issues to be mindful of when researching differently abled persons

(Source: Wiles et al., 2004)

Making sure that the needs of participants were consistently considered and met. For instance, the scheduled interview lasted between twenty and thirty minutes except for two interviews that had a duration of more than an hour. Although some participants took less time to complete the interview than allocated, others took longer. The length of the interview was determined by how much information each participant had to contribute, and the researcher encouraged the participants to express themselves.

Observing set responsibilities, such as maintaining ongoing consent, and ensuring that people were always represented during data collection, reminded participants of their choice to

withdraw the research at any time (Cutcliffe & Ramcharan, 2002). This was observed; no interview was conducted without the participant's written, verbal, and signed consent. Each participant verbally consented before the interviews began, and this was recorded in the interview videos.

Although relationships could form during the research, it was the researcher's duty to always maintain professionalism, both during and after the study. Additionally, the researcher also ensured the study's integrity by maintaining that, research activities were aligned with the study's goal. All participants found the topic of wearing the conventional academic dress to be emotional, even to the point of exposing unexpected recollections of embarrassing and humiliating situations on graduation day. As a result, the researcher needed to be sensitive, responsible, and capable of handling these conversations sensitively.

During the interviews, the interviewer provided the required pauses. Interviews could be postponed if the participants could arrange a suitable time at their earliest convenience.

With the participation of 15,000 people with disabilities, they were considered at the UN Convention on the (United Nations, 2006):

- **Promote inclusion and participation of differently abled persons:** The participants were supplied with the scope of questions before the interview, they reserve the right to change their decision to participate in this study. In this study all participants were emailed the agenda of the interview that contained the questions, see appendix 2, Interview agenda on pages 68-69. This was done to ensure transparency on what information will be needed from them, for this study, as well as to ensure that the participants were at ease with the interview.
- **Ensure access to differently abled persons:** The individual interviews were conducted on online platforms namely Zoom and Microsoft Teams. These were the two online platforms that were available to the participants, thus facilitating accessibility.
- **Avoid harm to research participants:** The interviewer had to be mindful and sensitive to the information shared during the interviews. To keep the identity of the participants confidential. All participants were allocated codes, namely, P1, P2, P3, P4 and P5.
- **Ensure voluntary and mindful consent before taking part in the research:** Consent was obtained both in verbally and written means before the interview started. Transparency between the participant and the interviewer was ensured by bringing clarity about the study before the interviews started.
- **Understanding and fulfilling legal responsibilities:** The interviewer was mindful of the basic human rights that all human beings have in South Africa, this included all

participants. This was done by ensuring that each participant was treated with respect throughout the entire interview and writing process. These rights were also observed when communicating with the participants both before and after the interview.

- **Maintain high professional research standards and competencies** (UN Convention, 2006): Operate professionally during the individual interviews and throughout this study. All interviews were carried out professionally. All interviews started at the agreed time, and both the interviewer and interviewee were focused on the interview. No major interruptions were experienced during all interviews.

Regarding this study, Burgstahler's process was applied as an overview guide in the design process. Seven of the eight steps were used for this study, step seven 'train and support' was not relevant for this study, as there is no need for training on the use of the final product.

1. Identify the application.
2. Define the universe.
3. Involve consumers.
4. Adopt guidelines.
5. Apply the guidelines.
6. Plan for accommodation.
7. Train and support (not applicable in this study).
8. Evaluate.

Figure 3.5: Design thinking process (Source: Burgstahler, 2005)

3.11 User testing: Practical process

After the transcription process, the data were analysed, and the details of the data analysis process are unpacked in the next chapter. The analysis process ran parallel with the practical component (making the prototype) of the research as time was limited. In the second week of October manual pattern-making process of the inclusive academic gown for the mobility-impaired graduands started. This is the design that was informed by the users and all features that were discussed in the interviews were taken into consideration. The pattern was manually created on paper by the researcher and the sample was also sewn by the researcher. The model who fitted the sample was one of the participants who reside in Cape Town as the researchers are also based in Cape Town. See section 4.4 on user testing feedback. This was the first iteration of the inclusive academic gown.

The first fitting session highlighted the improvements that were necessary for the first iteration. The Technology station services for digital pattern making and technical drawing as well as

sample making of the second iteration were used. This process took a month, and the first sample was fitted on an abled body person see pictures in sections 4.16. After this fitting, the researcher and the technology station were informed of further changes that were needed on the inclusive academic gown. Two more samples were made and fitted on a differently abled participant, one with a shorter back and another with a full length, see pictures in figure 4.17 and 4.18 The feedback given on these fitting sessions assisted in the final alterations that were applied on the final garments worn during the photoshoot in section 4.7.

Included in the user testing practical process are the videos of the participant donning and doffing the inclusive academic gown, a feedback video as well as a video of the participant moving and pushing her wheelchair freely while wearing the inclusive academic gown is included in the appendices.

3.12 Data analysis

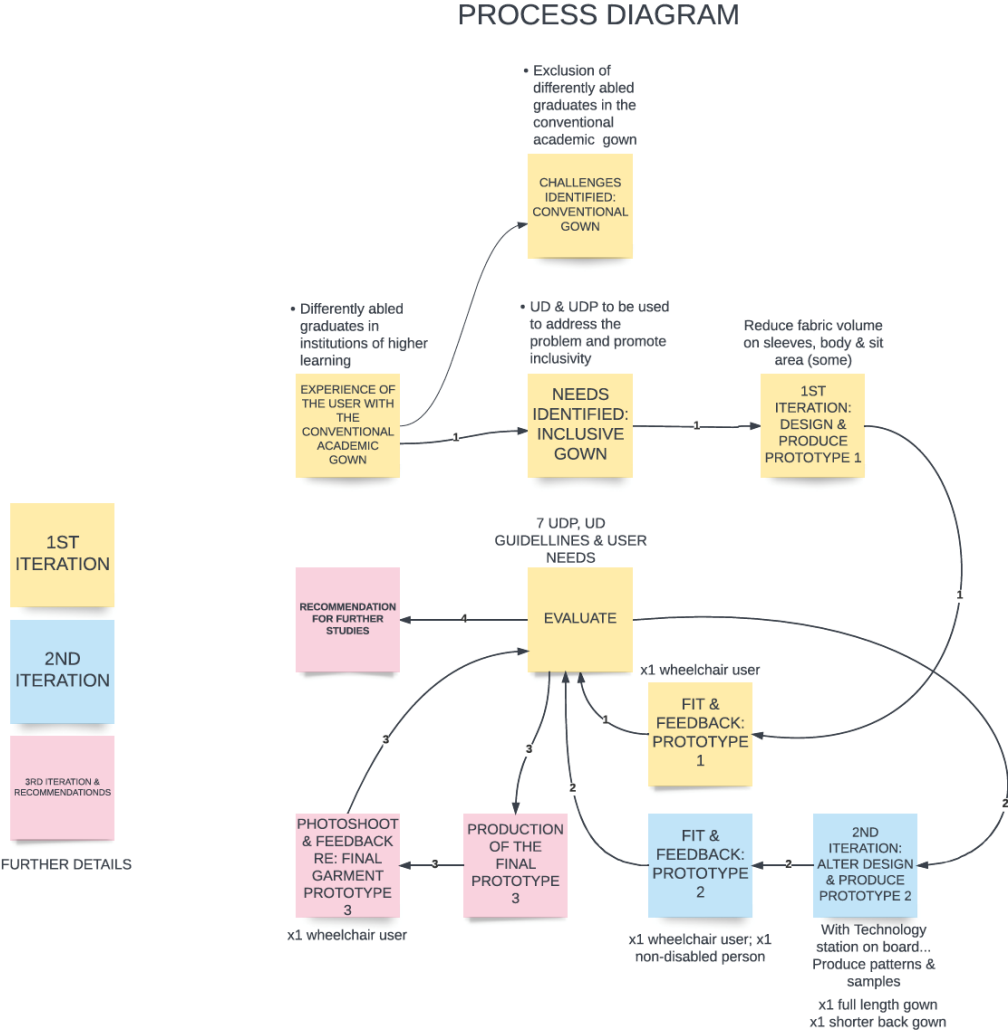


Figure 3.6: The Process diagram during iteration phases

(Source: Researcher)

Figure 3.6 captures the practical process that was followed during the iteration phases. The iteration process is explained in detail in the next chapter however, the following paragraphs briefly explain the above diagram. Note that the bold words represent the colour-coded squares on the practical process diagram. The process starts from left to right following the numbered arrows and colour-coded squares. The process starts with the top yellow square, namely, the **experience of the users**. At this stage, data were shared by the users with the researcher through one-on-one interviews. Through these interviews the needs of the users were made known to the researcher and translated into garment form which is called **1st iteration (prototype 1)**. The detailed translation process of the data into the garment is captured in the data analysis section in the next chapter.

Thereafter a **fitting and feedback session of the prototype** was done. This process led to the; **evaluation stage** where the alteration of the original design was done. The altered design was then called **2nd iteration (prototype 2)**; this process too is captured in detail with pictures of the process in the next chapter. Another **fitting and feedback session** was done. Another **evaluation** was done before the production of the **final garments (prototype 3)** that were documented in a photoshoot, where the participant fitted all three garments, namely: i) the conventional gown; ii) the full-length inclusive academic gown; and iii) the shorter back inclusive academic gown. The details are shown in photographs in the next chapter. After the **photoshoot and feedback session**, the necessary **recommendations** were given. All the stages of the practical process are labelled and explained in detail including pictures in Chapter 4.

Underpinning the above practical process is the theoretical framework of this study which is Universal Design and its Principles. All codes were extracted from working through the data alongside the UDP in each iteration. In each of the iteration stages illustrated above the seven UDP were considered as this was the main concern of this study; design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialised design (Connell et al., 1997:281). A consistent approach was used when creating these academic gown products, wherein all users were treated equally and considered during the design stage and afterwards in the final product. The final product of this study is an academic gown that will be usable by all users, or a suitable academic gown option made available to users who are mobility impaired. This suitable option will not require alterations but rather be ready for use as needed.

In each iteration, the UDPs were considered alongside the feedback from the fitting sessions. This allowed the researcher to action the needs communicated by the user during the fitting

session onto the next iteration to improve and fine-tune the design to be suitable to the user. This step-by-step process is covered in the next chapter.

3.12.1 Thematic analysis

The collected data were analyzed using thematic analysis (TA). Maguire and Delahunt (2017: 3352) describe thematic analysis as a process of identifying patterns or themes within qualitative data. Qualitative data may be collected through in-depth interviews, field observations or focus groups. Thematic analysis is a method that helps the researcher organise the information gathered to answer the study's research questions (Guest et al., 2012). TA suited this study well because the six-step process allows for a thorough working through of the collected data so that the message that was communicated by the users may be known and addressed in the product production part of the research. Braun and Clarke, (2006) originally developed the six-step framework, see Figure 3.7, which serves as a guide for researchers using TA as a method of analysis, in their studies.

3.12.2 The six steps by Braun and Clarke

Data from the interview sessions that were analysed, was organised according to themes that were formed by similar statements from the participants. The steps in TA are as follows:

Step 1: Become familiar with the data: Interview videos were watched, and manual transcribing of each interview took place. The analysis technique included considering the participant's body language, their facial expressions, and the precise phrases they used to respond to queries. This analysis also incorporated written data. These factors were all significant in learning about the participant's experiences with academic dress. Though the body language was minimal because the participant's body movements were limited by their disabilities, speech content and facial expression were enlightening as they contained common patterns. All the participants were fluent in spoken English and were able to articulate and narrated their experiences well.

Step 2: Generate initial codes: The assistance of the software called Taguette for generating initial codes was sought. (Taguette is a coding software).

Step 3: Search for themes: This step was done by exporting the codes from Taguette to Excel and further working through the data to extract themes.

Step 4: Review themes: Here re-evaluate of existing themes was done to determine if all themes were still relevant or if there is a need to combine some themes into one theme.

Step 5: Define themes: On an Excel, spreadsheet themes were further defined and only those that were going to be used for this study appeared at this stage.

Step 6: Write-up of the analysis: Here the written detail about the process was captured, see section 4.1 for details and examples of the six-step TA process.

An overview of the six steps of thematic analysis is presented in figure 3.7.

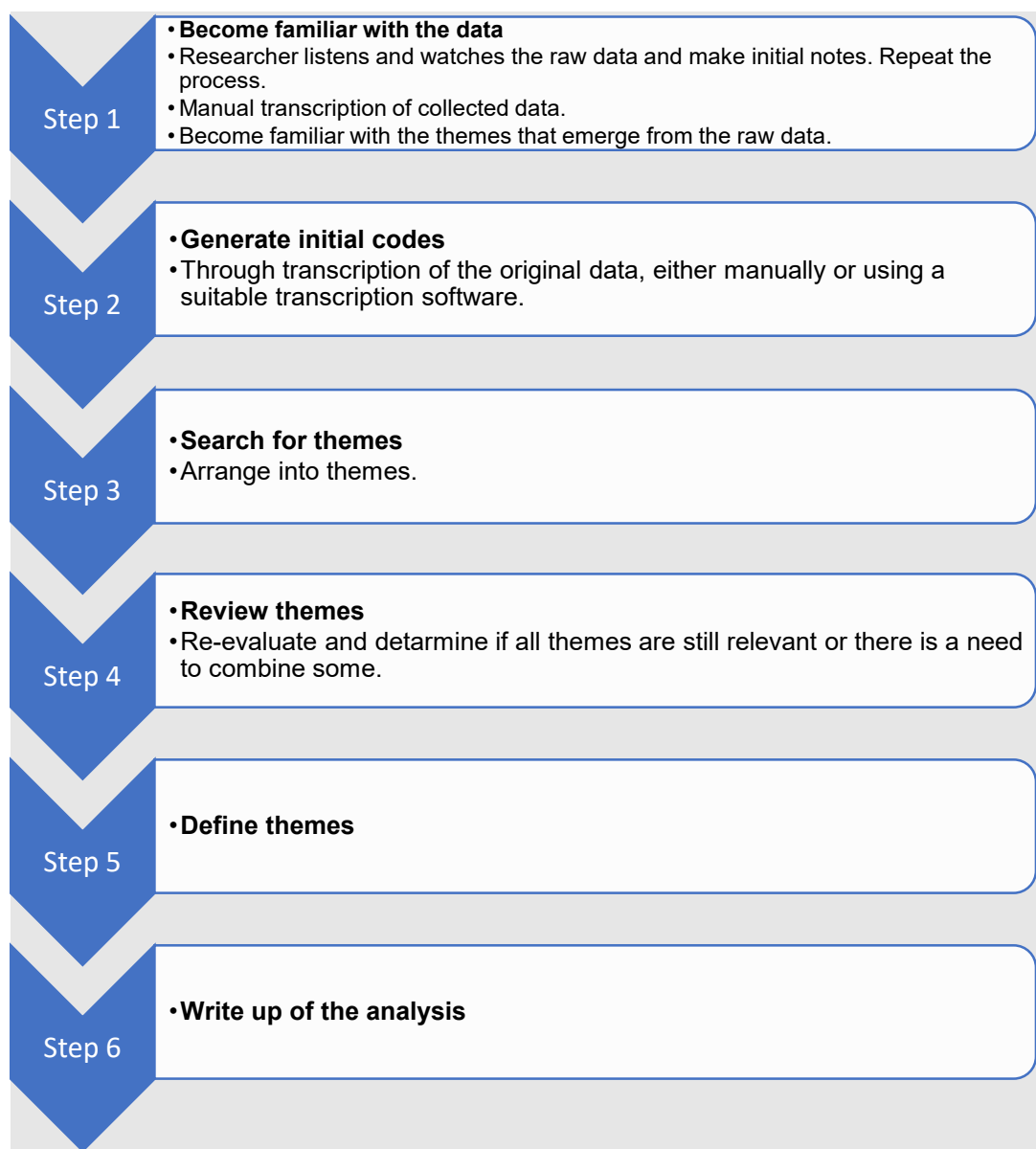


Figure 3.7: Six-step thematic analysis guide

(Source: Maguire & Delahunt, 2017)

Chapter 4: Findings

4.1 Introduction

This study employed a practice-based qualitative methodology. In practice-based research, an artefact becomes the central contribution of the study. According to Candy (2006:3), practice-based research (PBR) is an original investigation undertaken to gain new knowledge partly using practice and the outcomes of that practice. She further states that this kind of research has given rise to new concepts and methods in the generation of original knowledge. If a creative artefact is the basis of the contribution to knowledge, the research is practice-based (Candy, 2006:3). In this study the inclusive academic gown is the artifact. The prototyping was Practice-based.

The interviews were qualitative with the assistance of graduands with mobility impairments from a University of Technology and other South African institutions of higher education, the researcher conducted one-on-one interviews to gather their experience of the conventional academic gown. The study's participants provided insight into their own experiences with the conventional academic dress by sharing their stories. The data collected from the interviews were used to design and create inclusive, ergonomically sound, and purpose-driven academic gowns that are suited for all people, including differently abled persons.

The data analysis process of this study is unpacked below using a diagram with supporting tables that exhibit the researchers' approach. Each table is followed by a description of each iteration, including the design process from the first iteration to the second iteration, and these are covered in depth. The findings of this study are summarised towards the end of the chapter.

4.2 Data analysis

In the data analysis process, the researcher used Universal Design Principles (UDPs) and guidelines as a coding frame. Using the UDP enable researcher to focus on the needs articulated by the user. UDP take the user's needs into account to ensure that these needs are communicated to the designer so that the inclusive design of the academic gown accommodates these needs when developing product.

For this study, all seven UDP were used as a yard stick to determine if the conventional academic gown caters for all user's needs including people with mobility impairments, and further if the conventional academic gown was universally designed? UDP were used to

determine whether the inclusive academic gowns designed in this study were universally designed and whether they meet the needs of the user.

The data analysis process started with a digital data analysis program called Taguette, onto which all the interview transcripts were loaded, saved and thereafter thoroughly worked through. The researcher combed through each sentence in search for codes that were contained in the data. This process involved, first, highlighting all the sentences that presented information with the potential of contributing knowledge to the study (see figure 4.1), then sorting the highlighted data into initial coding buckets within Taguette (see figure 4.2). In Taguette, the term ‘tags’ is used to describe the initial code buckets. The seven UDP were used as code buckets as well as three additional code buckets, namely, *Other*, *Perceptions* and *Interesting*. It is important to note that data stored in the *Interesting*, bucket were identified for future studies and consequently were not used in this study. The ‘Other’ and ‘Perception’ data were later incorporated within the UDP codes when themes were formed from the extracted codes. Below, are examples of the initial highlighting and bucket coding processes in Taguette.

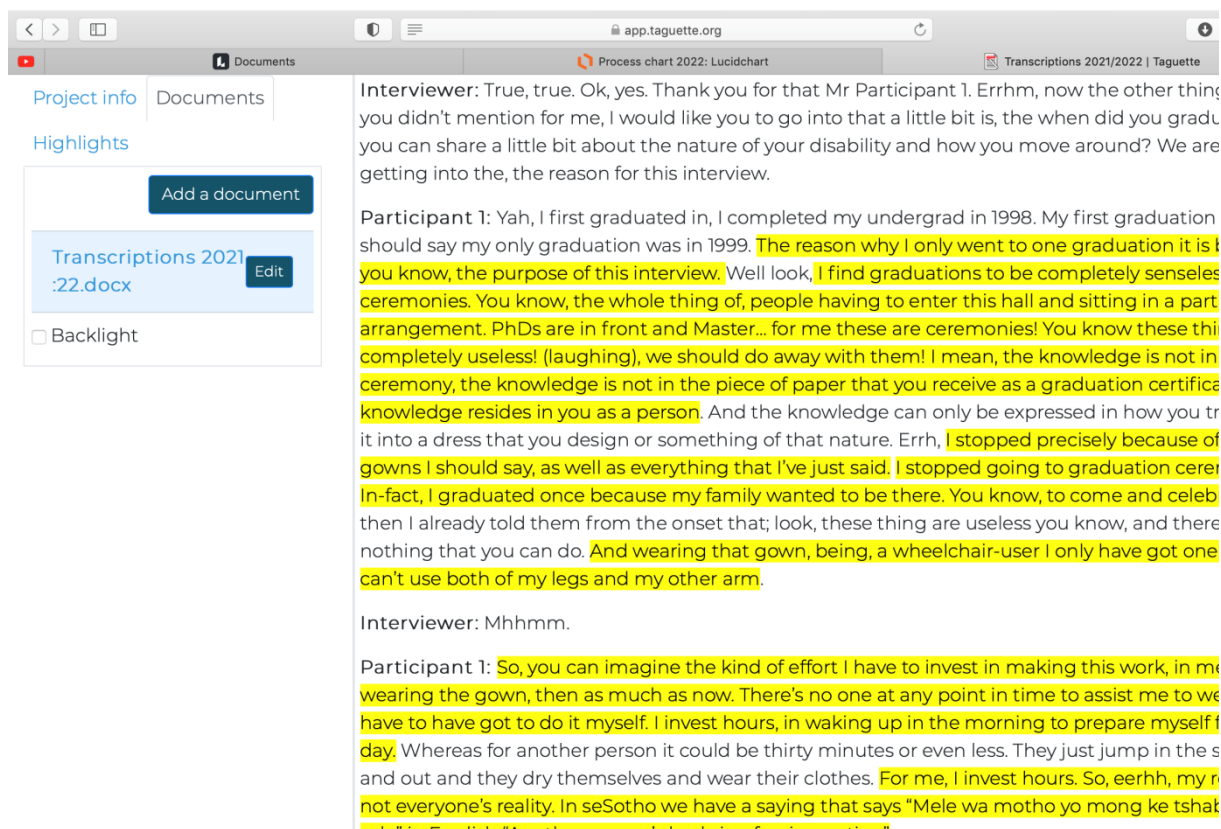


Figure 4.1: Initial highlighting process in Taugette (Source: Researcher)

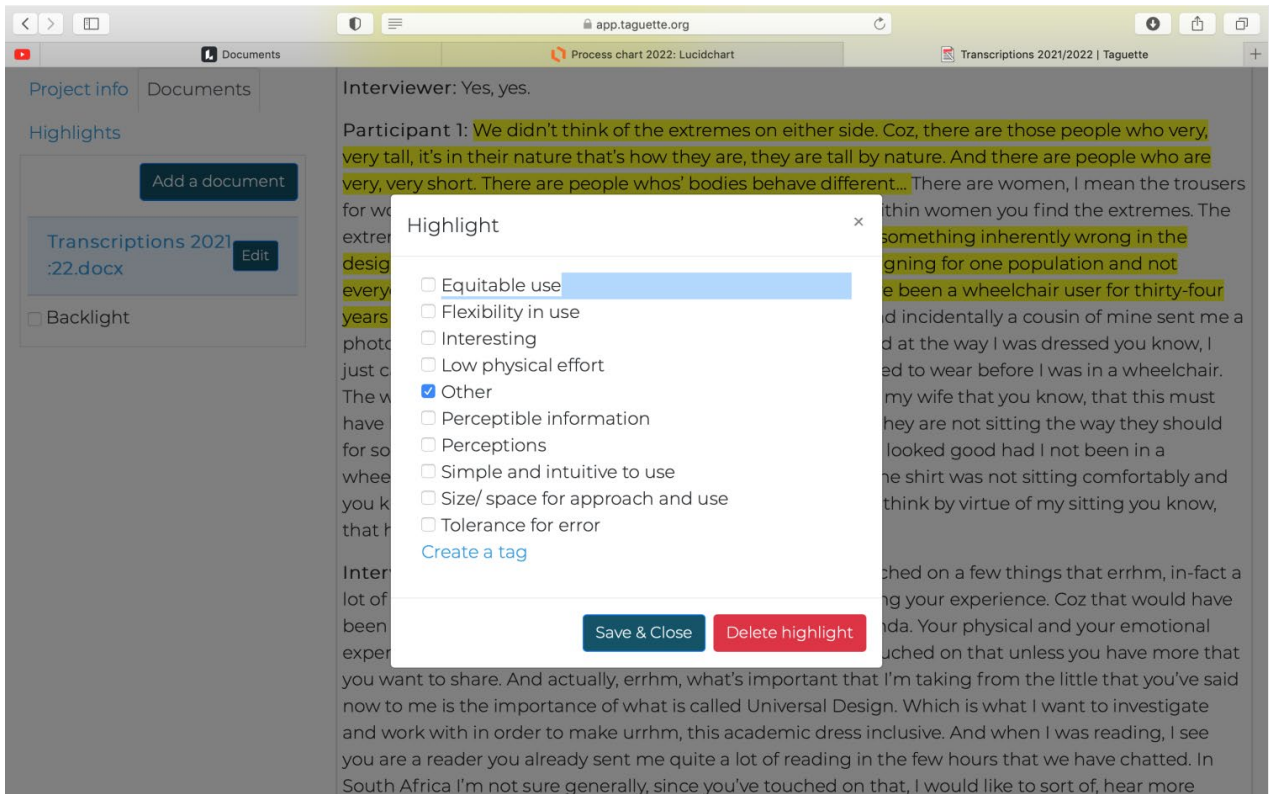


Figure 4.2: Initial bucket codes in Taguette
(Source: Researcher)

Following the initial bucket coding in Taguette explained above, all the highlighted quotes from participants were stored in respective code buckets. The document was then converted into an Excel document and further unpacked in Excel into Excel for further coding and theming process as seen in Figure 4.3.

id	document	tag	UD GUIDELINES	content
2560529	Transcriptions 2021:22.docx	Equitable use	Does not provide same means of use for all users.	I stopped precisely because of the gowns I should say, a
2560569	Transcriptions 2021:22.docx	Equitable use	Does not avoid segregation.	And wearing that gown, being, a wheelchair-user I only t
2560639	Transcriptions 2021:22.docx	Equitable use	Does not avoid segregation.	We didn't think of the extremes on either side. Coz, there
2560734	Transcriptions 2021:22.docx	Equitable use	Does not provide same means of use for all users.	I mean I'm saying the same with regards to the design fo
2560746	Transcriptions 2021:22.docx	Equitable use	Does not provide same means of use for all users.	I can put it to you in another way. When you say I'm dis
2560748	Transcriptions 2021:22.docx	Equitable use	Does not avoid segregation.	In the manner in which it is designed. It's not designed to
2560815	Transcriptions 2021:22.docx	Equitable use	Does not appeal to all users	Maybe you know, I mean you are in fashion, you can con
2560817	Transcriptions 2021:22.docx	Equitable use	Does not appeal to all users	First of all, I think you know, if we were to change eerb, e
2560824	Transcriptions 2021:22.docx	Equitable use	Does not appeal to all users	If we want to come up with a trouser, that fits both a man
2562922	Transcriptions 2021:22.docx	Equitable use	Does not provide same means of use for all users.	Now, getting the gown, you obviously know that, you wor
2562966	Transcriptions 2021:22.docx	Equitable use	Does not provide same means of use for all users.	So there not really any barriers, when it comes to that bu
2567601	Transcriptions 2021:22.docx	Equitable use	Does not provide safety, design does not appeal to all users.	But the important point you have raised, is that it might b
2567618	Transcriptions 2021:22.docx	Equitable use	Does not avoid segregation.	Because that is a indirect, uuhhm what it's called is: it's ir
2567620	Transcriptions 2021:22.docx	Equitable use	Does not provide safety, design does not appeal to all users.	Or somebody that has short legs! Or somebody that has i
2567767	Transcriptions 2021:22.docx	Equitable use	Does not provide safety, design does not appeal to all users.	Sindiswa, I personally know people. I know a person wit
2567770	Transcriptions 2021:22.docx	Equitable use	Does not provide same means of use for all users.	They are not attending because of this reason why we ar
2567813	Transcriptions 2021:22.docx	Equitable use	Does not provide safety, design does not appeal to all users.	Because you are taking my mind back at the day of grad
2567907	Transcriptions 2021:22.docx	Equitable use	Provide same means for all users.	This is brilliant and very thoughtful. It would make differe
2567928	Transcriptions 2021:22.docx	Equitable use	Provide same means for all users.	No, honestly, I did not experience any challenges with re
2560529	Transcriptions 2021:22.docx	Flexibility in use	Does not provide choice in methods of use.	I stopped precisely because of the gowns I should say, a
2560569	Transcriptions 2021:22.docx	Flexibility in use	Does not provide right or left-handed access and use.	And wearing that gown, being, a wheelchair-user I only t
2560580	Transcriptions 2021:22.docx	Flexibility in use	Does not provide choice in methods of use.	So, you can imagine the kind of effort I have to invest in
2560594	Transcriptions 2021:22.docx	Flexibility in use	Does not provide adaptability to the user's pace.	For me, I invest hours. So, eerbh, my reality is not everyo
2560639	Transcriptions 2021:22.docx	Flexibility in use	Does not accommodate extremes (very tall/ very short).	We didn't think of the extremes on either side. Coz, there
2560734	Transcriptions 2021:22.docx	Flexibility in use	Does not provide choice in methods of use.	I mean I'm saying the same with regards to the design fo
2560746	Transcriptions 2021:22.docx	Flexibility in use	Does not provide choice in methods of use.	I can put it to you in another way. When you say I'm dis
2560748	Transcriptions 2021:22.docx	Flexibility in use	Does not provide choice in methods of use.	In the manner in which it is designed. It's not designed to

Figure 4.3: Initial codes and quotes in Excel
(Source: Researcher)

The next step of analysis was to extract information by identifying similarities within the data and grouped those to form themes according to the information embedded in them. This spreadsheet is made up of the UDP, the UDP guidelines, the number of times each statement from the participants appeared in each bucket code; with these then being evaluated against each UDP guideline. From these numbered statements one or more themes were formed. See Figure 4.4 as an example of the process on an Excel spreadsheet below.

Universal Design Principles	Universal Design Guidelines	Number of statements against Guidelines	Themes extracted	Supporting sentences
Equitable use	Does not provide same means of use for all users.	Does not provide same means of use for all users = 6	The conventional academic gown promotes segregation and does not appeal to all users.	1. And wearing that gown, being, a wheelchair-user 2. I can put it to you in another way. When you I say wearing the academic graduation gown it is because 3. In the manner in which it is designed. It's not design gown is made for a specific, for a very thin layer of t It was not designed for me. It was designed for them 4. But the important point you have raised, is that it is sleeves, the sleeve could get entangled in the wheels my question to you then would be, why is it that the c 5. Or somebody that has short legs? Or somebody if 6. Sirdiana, I personally know people, I know a pers on a skateboard, so that gown that we have, how is i 7. They are not attending because of this reason why 8. Because you are taking my mind back at the day were so big, you can't push yourself, I had to be put push. Let me say, it's impossible to push, I had to as have a particular shape. It doesn't look good.
Equitable use	Does not avoid segregation.	Does not avoid segregation = 4		
Equitable use	Does not avoid segregation.	Does not appeal to all users = 3		
Equitable use	Does not provide same means for all users.	Does not provide safety, design does not appeal to all users = 4		
Equitable use	Does not provide same means for all users.	Provides the same means for all users = 2		
Equitable use	Does not avoid segregation.			
Equitable use	Does not appeal to all users			
Equitable use	Does not appeal to all users			
Equitable use	Does not provide same means for all users.			
Equitable use	Does not provide safety, design does not appeal to all users.			
Equitable use	Does not avoid segregation.			
Equitable use	Does not provide safety, design does not appeal to all users.			
Equitable use	Does not provide same means for all users.			
Equitable use	Does not provide safety, design does not appeal to all users.			
Equitable use	Does not provide same means for all users.			
Equitable use	Provide same means for all users.			
Equitable use	Provide same means for all users.			
Flexibility in use	Does not provide choice in methods of use.	Does not provide choice in method of use = 14	The conventional academic gown lacks choice and does not accommodate mobility impaired users as well as people with extreme body shapes.	1. And wearing that gown, being, a wheelchair-user 2. We didn't think of the extremes on either side. Co nature. And there are people who are very, very sho 3. I mean I'm saying the same with regards to the de 4. In the manner in which it is designed. It's not desi gown is made for a specific, for a very thin layer of It was not designed for me. It was designed for them
Flexibility in use	Does not provide right or left-handed access and use.	Does not provide right or left-handed access and use = 1		
Flexibility in use	Does not provide choice in methods of use.	Does not provide adaptability to the user's pace = 1		
Flexibility in use	Does not provide adaptability to the user's pace.	Does not accommodate extremes (very tall/very short) = 1		

Figure 4.4: Initial themes in Excel (Source: Researcher)

The themes were then sorted, and some were combined, see findings in section 4.9 for the final themes of this study. The next section presents the initial themes obtained from the data.

4.2.1 Initial themes found in data

- i) The conventional academic gown promotes segregation and does not appeal to all users.
- ii) The conventional academic gown lacks choice and does not accommodate mobility impaired users as well as people with extreme body shapes.
- iii) Inclusive academic gown will address key issues identified in the conventional gown.
- iv) The conventional gown promotes unnecessary toiling.
- v) The conventional academic gown promotes a disabling environment for mobility impaired persons.
- vi) Inclusive academic gown/gowns may promote positive emotional and physical graduation day experience.
- vii) The conventional academic gown does not provide compatibility with variety to accommodate people with limitations.

- viii) The conventional academic gown provides a sense of mixed emotions. Proud, excited, joyous, embarrassed, disabled, defeated.
- ix) The conventional academic gown promotes unnecessary complexity and does not meet the user's expectations and intuition.
- x) Inclusive gown may eliminate unnecessary complexity on the garment.
- xi) The conventional academic gown does not provide flexibility to make donning and doffing the garment easy.
- xii) The inclusive academic dress may address the challenges experienced in the process of donning and doffing.
- xiii) The conventional academic gown has elements that promotes potential hazards to mobility impaired users.
- xiv) The inclusive academic dress may eliminate the design element that are hazardous to mobility impaired users.

The themes were then used in the tables that illustrate the design process from the experience of the users about the conventional academic gown, to first and second iteration. Included in this process are the research questions that the table analysis sought to answer. It is imperative to highlight that all collected data were reviewed against the UDPs and Guidelines, as presented in the tables below. Before plunging into the analysis tables, it is critical to remind the reader of the study's research question, which served as guidance for gathering data from the participants.

Figure 4.5 presents the process diagram that captures the process that the researcher practically employed on this study, to capture the experiences of the users about the conventional academic gown as well as using the user's experience and needs to test the use of UDP in the inclusive academic gown.

4.5 Process Diagram

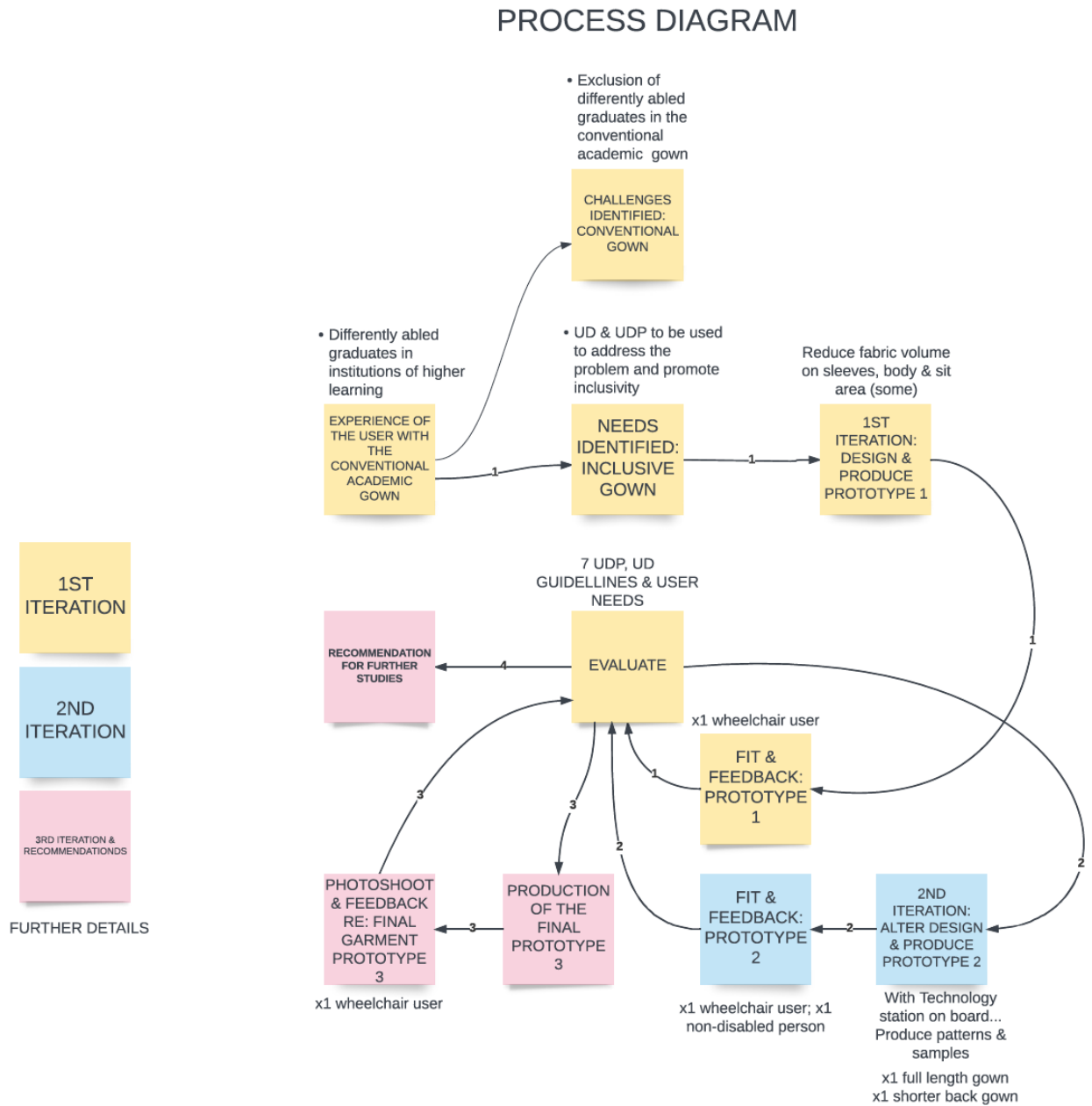


Figure 4.5: Process diagram
(Source: Researcher)

Table 4.1: Challenges and needs assessment table

(Source: Researcher)

Research Question 1: How did differently abled users experience the conventional academic dress? (To assess their challenges and needs).			
UDPs	Universal Design Guidelines	Conventional Gown	Supporting statements from collected data
<p>1. Equitable use: Being marketable to people with a wide range of abilities.</p>	<p>1a. Provides the same means of use for all users. 1b. Avoid segregation or stigmatising any users. 1c. Provisions for privacy, security and safety should be equally available to all users. 1d. Make the design appealing to all users.</p>	<p>1. Does not provide the same means of use to all users. 2. Does not avoid segregation or stigmatising users. 3. Does not appeal to all users. 4. Does not provide safety and the design does not appeal to all users.</p>	<p>1. P1: And wearing that gown, being, a wheelchair-user I only have got one arm, I can't use both of my legs and my other arm. 2. P1: I can put it to you in another way. When you say I'm disabled, I'm saying I am disabled by the design. The reason why I'm not wearing a gown, I'm not wearing the academic graduation gown is because that gown disables me. 3. P1: In the way it is designed. It's not designed to fit me properly you know. In a way I would like to be looked at. That gown is made for a specific, very thin layer of society. Which are not sitting in wheelchairs, and people who don't have mobility impairments. It was not designed for me. It was designed for them. So, by me wearing it, it disables me. 4. P3: I know people. I know a person without legs, so now he sits in the wheelchair, right! or he pulls him along with crutches, or he moves on a skateboard, so that gown that we have; how is that going to accommodate that student?</p>
<p>2. Flexibility in use: Individual preferences and abilities are accommodated in a wide range of ways.</p>	<p>2a. Provide choice in methods of use. 2b. Accommodate right- or left-handed access and use. 2c. Facilitate the user's accuracy and precision. 2d. Provide adaptability to the user's pace.</p>	<p>1. Does not provide choice in methods of use. 2. Does not accommodate extremes (very tall/ very short).</p>	<p>1. P1: We didn't think of the extremes on either side. Coz, there are those people who are very, very tall, it's in their nature that's how they are, they are tall by nature. And some people are very, very short. There are people whose bodies behave different.... 2. P1: I mean I'm saying the same with regards to the design for the non-disabled having to fit the disabled as well. It doesn't work. 3. P1: In the way it is designed. It's not designed to fit me properly you know. In a way I would like to be looked at. That gown is made for a specific, very thin layer of society. Which are not sitting in wheelchairs, and people who don't have mobility impairments. It was not designed for me. It was designed for them. So, by me wearing it, it disables me. 4. P3: Or somebody that has short legs! Or somebody that has no arms!</p>

Research Question 1: How did differently abled users experience the conventional academic dress? (To assess their challenges and needs).			
UDPs	Universal Design Guidelines	Conventional Gown	Supporting statements from collected data
<p>3. Simple and intuitive to use: Irrespective of skill/ knowledge level, simple to comprehend.</p>	<p>3a. Eliminate unnecessary complexity. 3b. Be consistent with user expectations and intuition. 3c. Accommodate a wide range of literacy and language skills. 3d. Arrange information consistent with its importance. 3e. Provide effective prompting and feedback during and after task completion.</p>	<p>1. Does not eliminate unnecessary complexity. 2. Is not consistent with the user's expectations and intuition.</p>	<p>1. P1: And wearing that gown, being, a wheelchair-user I only have got one arm, I can't use both of my legs and my other arm. 2. P1: So, you can imagine the kind of effort I have to invest in making this work, in me wearing the gown, then as much as now. There's no one at any point in time to assist me to wear. I must have got to do it myself. I invest hours, in waking up in the morning to prepare myself for the day. 3. P4: Because you are taking my mind back to the day of graduation, I can remember, how big the gown was, it was huge, it's a huge dress hey. The sleeves were so big, you can't push yourself, I had to be pushed on the wheelchair coz the sleeves kept getting between the wheels of the wheelchair, so it was difficult to push. Let me say, it's impossible to push. I had to ask for assistance. Also, the way it sits on the body is just a bulky gown sitting on top of you. It doesn't have a particular shape. It doesn't look good. 4. P3: I know people. I know a person without legs, so now he sits in the wheelchair, right! or he pulls him along with crutches, or he moves on a skateboard, so that gown that we have; how is that going to accommodate that student?</p>
<p>4. Perceptible information: Despite abilities and other circumstances, efficiently provides the required information to the user.</p>	<p>4a. Provide compatibility with variety to accommodate people with limitations.</p>	<p>1. Does not provide compatibility with variety to accommodate people with limitations.</p>	<p>1. P3: But the important point you have raised, is that it might be a challenge for a paraplegic, a person that is pushing her or his wheelchair. Because the sleeves, the sleeve could get entangled in the wheels and the length of the gown can be tangled in the wheels, without a doubt, that's without a doubt! So, my question to you then would be; why is it that the design is what it is on the gown?</p>
<p>5. Tolerance for error: Reduces the risk of unexpected or unintentional actions.</p>	<p>5a. Provides elements that minimise hazards and errors.</p>	<p>1. Does not provide elements that minimise hazards and errors.</p>	<p>1. P2: The challenge that I've experienced with wearing the gown was, um it will, all the time will slide off my shoulders. So, I always had to sort of adjust and sort of keep it together so that it doesn't sort of like slide off. So, for me, that was probably errhmm, eehm the greatest challenge of the gown. 2. P2: Yes, yes, yes, coz the walking was the main challenge part of wearing the gown. So, in fact, like for me, I only sort of putting the gown when I was uuhm, near the venue, the hall.</p>

Research Question 1: How did differently abled users experience the conventional academic dress? (To assess their challenges and needs).			
UDPs	Universal Design Guidelines	Conventional Gown	Supporting statements from collected data
			<p>That's only when I sort of put on the gown coz walking with it from wherever it was quite challenging for me.</p> <p>3. P3: So, there are not any barriers when it comes to that, but I want to bring to your attention the person with no legs, the person with no arms, the person with one leg, the midget. And these are the types of disabilities that can find a challenge when it comes to the gown.</p> <p>4. P4: Because you are taking my mind back to the day of graduation, I can remember, how big the gown was, it was huge, it's a huge dress hey. The sleeves were so big, you can't push yourself, I had to be pushed on the wheelchair coz the sleeves kept getting between the wheels of the wheelchair, so it was difficult to push. Let me say, it's impossible to push. I had to ask for assistance. Also, the way it sits on the body is just a bulky gown sitting on top of you. It doesn't have a particular shape. It doesn't look good.</p>
<p>6. Low physical effort: Can be used efficiently and effectively while causing the least amount of strain.</p>	<p>6a. Allow the user to maintain a neutral body position.</p> <p>6b. Use reasonable operating forces.</p> <p>6c. Minimize repetitive actions.</p> <p>6d. Minimize sustained physical effort.</p>	<p>1. Does not minimise sustained physical effort.</p> <p>2. Does not allow the user to maintain a natural body position.</p>	<p>1. P1: So, you can imagine the kind of effort I have to invest in making this work, in me wearing the gown, then as much as now. There's no one at any point in time to assist me to wear. I must have got to do it myself. I invest hours, in waking up in the morning to prepare myself for the day.</p> <p>2. P1: For me, I invest hours. So, ehhh, my reality is not everyone's reality. In Sesotho, we have a saying that says "Mele wa motho yo mong ke tshaba se sele" in English "Another person's body is a foreign nation"</p> <p>3. P2: Yes, yes, yes, coz the walking was the main challenge part of wearing the gown. So, in fact, like for me, I only sort of put on the gown when I was uuhm, near the venue, the hall. That's only when I sort of put on the gown coz walking with it from wherever it was quite challenging for me.</p> <p>4. P4: Because you are taking my mind back to the day of graduation, I can remember, how big the gown was, it was huge, it's a huge dress hey. The sleeves were so big, you can't push yourself, I had to be pushed on the wheelchair coz the sleeves kept getting between the wheels of the wheelchair, so it was difficult to push. Let me say, it's impossible to push. I had to ask for assistance. Also, the way it sits on the body is</p>

Research Question 1: How did differently abled users experience the conventional academic dress? (To assess their challenges and needs).			
UDPs	Universal Design Guidelines	Conventional Gown	Supporting statements from collected data
			just a bulky gown sitting on top of you. It doesn't have a particular shape. It doesn't look good.
<p>7. Size/ space for approach and use: Irrespective of body size, posture, or mobility, appropriate size and/or space for manipulation</p>	<p>7a. Provide adequate space for the use of assistive devices/ wheelchairs. 7b. Provide flexibility: easy donning and doffing.</p>	<p>1. Is not easy to don and doff for mobility impaired users.</p>	<p>1. P1: And wearing that gown, being, a wheelchair-user I only have got one arm, I can't use both of my legs and my other arm.</p> <p>2. P2: The challenge that I've experienced with wearing the gown was, um it will, all the time will slide off my shoulders. So, I always had to sort of adjust and sort of keep it together so that it doesn't sort of like slide off. So, for me, that was probably ehm, eerhm the greatest challenge of the gown.</p> <p>3. P4: Because you are taking my mind back to the day of graduation, I can remember, how big the gown was, it was huge, it's a huge dress hey. The sleeves were so big, you can't push yourself, I had to be pushed on the wheelchair coz the sleeves kept getting between the wheels of the wheelchair, so it was difficult to push. Let me say, it's impossible to push. I had to ask for assistance. Also, the way it sits on the body is just a bulky gown sitting on top of you. It doesn't have a particular shape. It doesn't look good.</p>

4.2.2 The experience of the users with the conventional academic gown (Challenges & Needs Assessment)

To answer the first research question, Table 4.1 first shows two columns: the first column shows the original UDP, and second column shows the UD Guidelines. The third column evaluates the conventional academic gown against the UDP and UD Guidelines to find out if UDP and Guidelines are represented in the conventional academic gown. In the last column are statements from the participants about their experiences in wearing the conventional academic gown. This data shows the challenges experienced by the participants with the conventional academic gown.

UDP 1: Equitability use

Does the conventional gown provide the same means for all users? Does it avoid segregation and stigmatisation? Does it provide safety and privacy? Is the academic gown appealing to all users?

The answers to this question indicated the experiences and the challenges expressed by differently abled users. The information drawn from these experiences showed that the conventional academic gown promotes segregation and does not appeal to all users. This is supported by the following statement from P1: "In the way it is designed. It's not designed to fit me properly you know. In a way I would like to be looked at. That gown is made for a specific, very thin layer of society. Which are not sitting in wheelchairs, and people who don't have mobility impairments. It was not designed for me. It was designed for them. So, by me wearing it, it disables me". This statement alone is packed with expression of exclusion experienced by the user when he recalled his experience during his graduation. He was expected to wear an academic gown that was not suitable for his body needs as a wheelchair user with one working arm. He went as far as to interrogate the origin and design of the conventional academic gown and who it was designed for? His view was that, that person was certainly not a wheelchair user, this is because of the way the garment was designed. It was not a design suitable for wheelchair users.

UDP 2: Flexibility in use

Does the conventional academic gown provide choice in methods of use? Does it accommodate extremes (very tall/ very short) people?

The experiences of the participants about the conventional academic gown were that it lacks choice and does not accommodate mobility impaired users as well as people with extreme body shapes. P1: "We did not think of the extremes on either side. Coz, there are those people who

are very, very tall, it is in their nature that is how they are, they are tall by nature. And some people are noticeably short. There are people whose bodies behave different.” P3: “Or somebody that has short legs! Or somebody that has no arms!” These two quotes from the participants show that people with extreme bodies are indeed excluded and not catered for in the conventional academic gown design. People who are very tall may struggle with getting the correct length garment as well as noticeably short people may not get the suitable size and length. The design is meant for an average height person. It comes in different standard height sizes, not extreme.

UDP 3: Simple and intuitive to use

Does eliminate unnecessary complexity? Is it consistent with the user’s expectations and intuition?

Based on the feedback from the participants, the conventional academic gown promotes unnecessary complexity and does not meet the user’s expectations and intuition. P4: “Because you are taking my mind back to the day of graduation, I can remember, how big the gown was, it was huge, it is a huge dress hey. The sleeves were so big, you cannot push yourself, I had to be pushed on the wheelchair coz the sleeves kept getting between the wheels of the wheelchair, so it was difficult to push. Let me say, it is impossible to push. I had to ask for assistance. Also, the way it sits on the body is just a bulky gown sitting on top of you. It does not have a particular shape. It does not look good.”

P3: “I know people. I know a person without legs, so now he sits in the wheelchair, right! or he pulls him along with crutches, or he moves on a skateboard, so that gown that we have; how is that going to accommodate that student?” The above quotes show that the complexity of the design promotes unnecessary complexity and thus makes it difficult for the user to move in accordance with their intuition.

UDP 4: Perceptible information

Does the conventional gown provide compatibility with variety to accommodate people with limitations.

The feedback from participants showed that the conventional academic gown does not provide compatibility with variety to accommodate people with limitations. P3: “But the crucial point you have raised, is that it might be a challenge for a paraplegic, a person that is pushing her or his wheelchair. Because the sleeves, the sleeve could get entangled in the wheels and the length of the gown can be tangled in the wheels, without a doubt, that is without a doubt! So, my question to you then would be; why is it that the design is what it is on the gown?” The previous

quote brings attention to the unsuitability of the conventional gown for differently abled persons who may be sitting in a wheelchair, he goes further to question why the conventional gown is designed in the manner that it is?

UDP 5: Tolerance for error

Does the conventional academic gown provide elements that minimise hazards and errors?

The participants reported that the conventional academic gown has elements that promotes potential hazards to mobility impaired users. P2: “The challenge that I have experienced with wearing the gown was, um it will, all the time will slide off my shoulders. So, I always had to sort of adjust and sort of keep it together so that it does not sort of like slide off. So, for me, that was ehhm, eehm the greatest challenge of the gown.”

P2: “Yes, yes, yes, coz the walking was the main challenge part of wearing the gown. So, in fact, like for me, I only put the gown on when I was uuhm, near the venue, the hall. That is only when I put on the gown coz walking with it from wherever it was quite challenging for me.” P4: “Because you are taking my mind back to the day of graduation, I can remember, how big the gown was, it was huge, it is a huge dress hey. The sleeves were so big, you cannot push yourself, I had to be pushed on the wheelchair coz the sleeves kept getting between the wheels of the wheelchair, so it was difficult to push. Let me say, it is impossible to push. I had to ask for assistance. Also, the way it sits on the body is just a bulky gown sitting on top of you. It does not have a particular shape. It does not look good.” The above statements clearly illustrate the challenges the participants experienced with the conventional academic gown and that indeed according to their experiences it had elements that promoted potential hazards to the wearer. With the first participant, if the garment slid-off the shoulders and fell while it was worn it would have been a tripping hazard to the wearer. The same goes with the last statement. The participant could not push herself while wearing the academic gown as she feared that the sleeves would get caught in the wheels and cause an accident.

UDP 6: Low physical effort

Does it minimise sustained physical effort? Does it allow the user to maintain a natural body position?

The participants reported that the conventional gown promotes unnecessary toiling. P1: “So, you can imagine the kind of effort I have to invest in making this work, in me wearing the gown, then as much as now. There is no one at any point in time to assist me to wear. I must do it myself. I invest hours, in waking up in the morning to prepare myself for the day.” P4: “Because you are taking my mind back to the day of graduation, I can remember, how big the gown was,

it was huge, it is a huge dress hey. The sleeves were so big, you cannot push yourself, I had to be pushed on the wheelchair coz the sleeves kept getting between the wheels of the wheelchair, so it was difficult to push. Let me say, it is impossible to push. I had to ask for assistance. Also, the way it sits on the body is just a bulky gown sitting on top of you. It does not have a particular shape. It does not look good.” the above statements express the amount of physical effort that the participants put into wearing the conventional gown in the process of donning and doffing as well as wearing it was not a pleasure but a burden.

UDP 7: Size/space for approach and use

Does the conventional gown provide adequate space for the use of assistive devices/wheelchairs? Does it provide flexibility: easy donning and doffing?

The participants reported that the conventional academic gown does not provide flexibility to make donning and doffing the garment easy. P1: “And wearing that gown, being, a wheelchair-user I only have got one arm, I can’t use both of my legs and my other arm.” P2: “The challenge that I have experienced with wearing the gown was, um it will, all the time will slide off my shoulders. So, I always had to sort of adjust and sort of keep it together so that it does not sort of like slide off. So, for me, that was eehm, eehm the greatest challenge of the gown.” The statements above show that the physical disabilities of the participants were not accommodated in the conventional academic gown for instance the first statement shows that having one arm and wearing a garment with volume on both body and sleeve is bound to be problematic for the user. The second statement shows that the participant struggled to keep the academic gown in place while wearing it.

Table 4.2: Solutions through Universal Design (Source: Researcher)

Research Question 2: To what extent can UDPs guide the design of an inclusive academic gown?			
UDPs	Universal Design Guidelines	Inclusive Gown	Solution applied: Iteration 1
<p>1. Equitable use: Being marketable to people with a wide range of abilities.</p>	<p>1a. Provides the same means of use for all users. 1b. Avoid segregation or stigmatising any users. 1c. Provisions for privacy, security and safety should be equally available to all users. 1d. Make the design appealing to all users.</p>	<p>1. Provide the same means of use to all users. 2. Avoid segregation or stigmatising users. 3. Appeal to <i>most</i> users. 4. Provide safety and make the design appealing to all users.</p>	<p>1. The fabric volume in the design of the inclusive garment on sleeves and body section can be drastically reduced and thus reducing the weight of the inclusive gown. 2. The reduction of the fabric volume will result in the inclusive gown look changing to a more appealing and modern garment. 3. The inclusive academic gown will be suitable for both differently abled persons as well as able-bodied people.</p>
<p>2. Flexibility in use: Individual preferences and abilities are accommodated in a wide range of ways.</p>	<p>2a. Provide choice in methods of use. 2b. Accommodate right- or left-handed access and use. 2c. Facilitate the user's accuracy and precision. 2d. Provide adaptability to the user's pace.</p>	<p>1. Provides choice in methods of use. 2. Accommodate extremes (very tall/ very short).</p>	<p>1. The inclusive academic gown can be graded into multiple lengths to accommodate a variety of users, including people who are both very tall and very short. 2. For differently abled users who are still not accommodated in the inclusive academic gown, a custom-designed inclusive gown option can be taken into consideration.</p>
<p>3. Simple and intuitive to use: Irrespective of skill/ knowledge level, simple to comprehend.</p>	<p>3a. Eliminate unnecessary complexity. 3b. Be consistent with user expectations and intuition. 3c. Accommodate a wide range of literacy and language skills. 3d. Arrange information consistent with its importance. 3e. Provide effective prompting and feedback during and after task completion.</p>	<p>1. Eliminate unnecessary complexity. 2. Be consistent with the user's expectations and intuition.</p>	<p>1. The inclusive garment will be more manageable to don and doff. 2. The user will be able to push themselves in the wheelchair while wearing the inclusive academic gown because there will no longer be fabric volume on the sleeve to prohibit the user from pushing themselves. 3. The look and fit of the inclusive academic gown will improve thus more pleasing to the user.</p>
<p>4. Perceptible information: Despite abilities and other circumstances, efficiently provides the required information to the user.</p>	<p>4a. Provide compatibility with variety to accommodate people with limitations.</p>	<p>1. Provide compatibility with variety to accommodate people with limitations.</p>	<p>1. The inclusive academic gown can be graded into different sizes to suit a wide range of users including grading into suitable lengths for very tall and very short users. 2. UD allows for adaptation where inclusion is not possible.</p>

Research Question 2: To what extent can UDPs guide the design of an inclusive academic gown?			
UDPs	Universal Design Guidelines	Inclusive Gown	Solution applied: Iteration 1
<p>5. Tolerance for error: Reduces the risk of unexpected or unintentional actions.</p>	<p>5a. Provides elements that minimise hazards and errors.</p>	<p>1. Provide elements that minimise hazards and errors.</p>	<p>1. The drastic reduction of fabric volume used can be applied in the body and sleeve design of the inclusive garment, which will also decrease the weight of the inclusive gown. This drastic volume reduction will mean that potentially dangerous elements will be removed from the design of the inclusive academic gown. The inclusive gown will be a safe garment to wear while the user is walking or pushing themselves in the wheelchair.</p>
<p>6. Low physical effort: Can be used efficiently and effectively while causing the least amount of strain.</p>	<p>6a. Allow the user to maintain a neutral body position. 6b. Use reasonable operating forces. 6c. Minimize repetitive actions. 6d. Minimize sustained physical effort.</p>	<p>1. Minimise sustained physical effort. 2. Allow the user to maintain a natural body position.</p>	<p>1. The inclusive academic gown will require less physical effort to don and doff because of the reduced fabric volume. Since there will be no additional weight, wearing the inclusive academic gown will require no more physical effort. 2. The garment will be held in place even when the user is walking owing to trimmings at the neckline and bodice area of the centre front, which will eliminate falling off the shoulders.</p>
<p>7. Size/ space for approach and use: Irrespective of body size, posture, or mobility, appropriate size and/or space for manipulation</p>	<p>7a. Provide adequate space for the use of assistive devices/ wheelchairs. 7b. Provide flexibility: easy donning and doffing.</p>	<p>1. Provide adequate space to allow for easy donning and doffing for mobility-impaired users.</p>	<p>1. The volume of the fabric used in the design of the inclusive garment will be significantly reduced on the body and sleeve sections, decreasing the weight of the inclusive academic gown, and enhancing reach when donning and doffing the inclusive academic gown.</p>

4.2.3 UDPs guide the design of an inclusive academic gown (First Iteration Design and Produce Prototype 1)

Table 4.2 answers the second research question and illustrates the extent to which the UDP and UD guidelines were applied in the design of an inclusive academic gown. Design solutions are shown in the last column. These were applied in the first iteration of this study.

UDP 1: Equitability use

The inclusive design should provide the same means of use to all users. It should avoid segregation or stigmatising users, appeal to *most* users, provide safety and appeal to all users. Solutions were to reduced fabric volume on sleeves and body of the inclusive academic gown thus changing the look to a more modern and appealing garment. The inclusive academic gown will be suitable for both differently abled and people without disabilities.

UDP 2: Flexibility in use

The inclusive garment should provide choice in methods of use and accommodate extremes (very tall/ noticeably short). Solution are that the inclusive academic gown can be graded into multiple lengths to accommodate a variety of users, including people who are both very tall and noticeably short. For differently abled users who are still not accommodated in the inclusive academic gown, a custom-designed inclusive gown option can be taken into consideration.

UDP 3: Simple and intuitive to use

The inclusive academic gown should eliminate unnecessary complexity and be consistent with the user's expectations and intuition. Solutions were to remove excess fabric volume from the design of the inclusive academic gown ensuring that through the inclusive design wheelchair users will be able to push themselves. The inclusive garment will be more manageable to don and doff without assistance. The look and fit of the inclusive academic gown will improve thus more pleasing to the user.

UDP 4: Perceptible information

The inclusive garment should provide compatibility with variety to accommodate people with limitations. Solutions are, that the inclusive academic gown can be graded into multiple lengths to accommodate a variety of users, including people who are both very tall and noticeably short. For differently abled users who are still not accommodated in the inclusive academic gown, a custom-designed inclusive gown option can be taken into consideration.

UDP 5: Tolerance for error

The inclusive garment should provide elements that minimise hazards and errors. Solutions applied were that the reduction of fabric volume on body and sleeves of the conventional garment eliminates the risk of injuries that could have been caused by the unsafe garment. This resulted in the inclusive gown that is safe to wear while the user is walking or pushing themselves in the wheelchair.

UDP 6: Low physical effort

The inclusive garment should minimise sustained physical effort and allow the user to maintain a natural body position. Solutions that were made were the reduction in fabric volume in the inclusive design reduced the physical toiling and time require to don and doff the inclusive academic gown. Also, trims were attached at centre front neckline and bodice of the garment to assist in keeping the garment in place even when the user is walking preventing it from falling-off the shoulders.

UDP 7: Size/space for approach and use

The inclusive garment should provide adequate space to allow for easy donning and doffing for mobility-impaired users. Solution applied was to reduce the volume of the fabric used in the inclusive garment on the body and sleeve sections, this then decrease the weight of the inclusive academic gown and enhanced reach when donning and doffing the inclusive academic gown.

4.3 First Iteration: Design and sample process

- i) Sketches were drawn by hand and later drawn by computer, using a computer aided design program. On paper the process started with the drafting of easy fitting over garment blocks and two-piece sleeve block. Thereafter adapted into a coat style taking into consideration all suggestions given to the researcher by the participants of the study, to make the academic gown inclusive and practical and wearable as well as the UDP guidance above in the first column of table 4.1.
- ii) Fabric was laid and a sample cut, the total rating of the garment for the large size amounted to five metres per garment, on the 150 cm wide black mini matt fabric.
- iii) The sample was sewn and first fitted on the mannequin to check for size and proportions. Thereafter the sample was fitted on one of the participants who gave feedback on the fit, feel, and look of the inclusive academic gown.

Below are the rough sketches drawn by the researcher during the research process and captured in the research journal. Figure 4.6 shows the sketch that was drawn originally before the interviews took place. This was based on the designers' thoughts, of how the garment should look like. The centre front of the academic gown is mock (non-functional) with a wrap detail on the left shoulder to allow for wearing and taking off, of the garment. The sleeves are two-piece narrow jacket sleeves, to allow for the pushing of the wheelchair. The back length is shorter (up to the waistline) to allow for comfort when sitting.

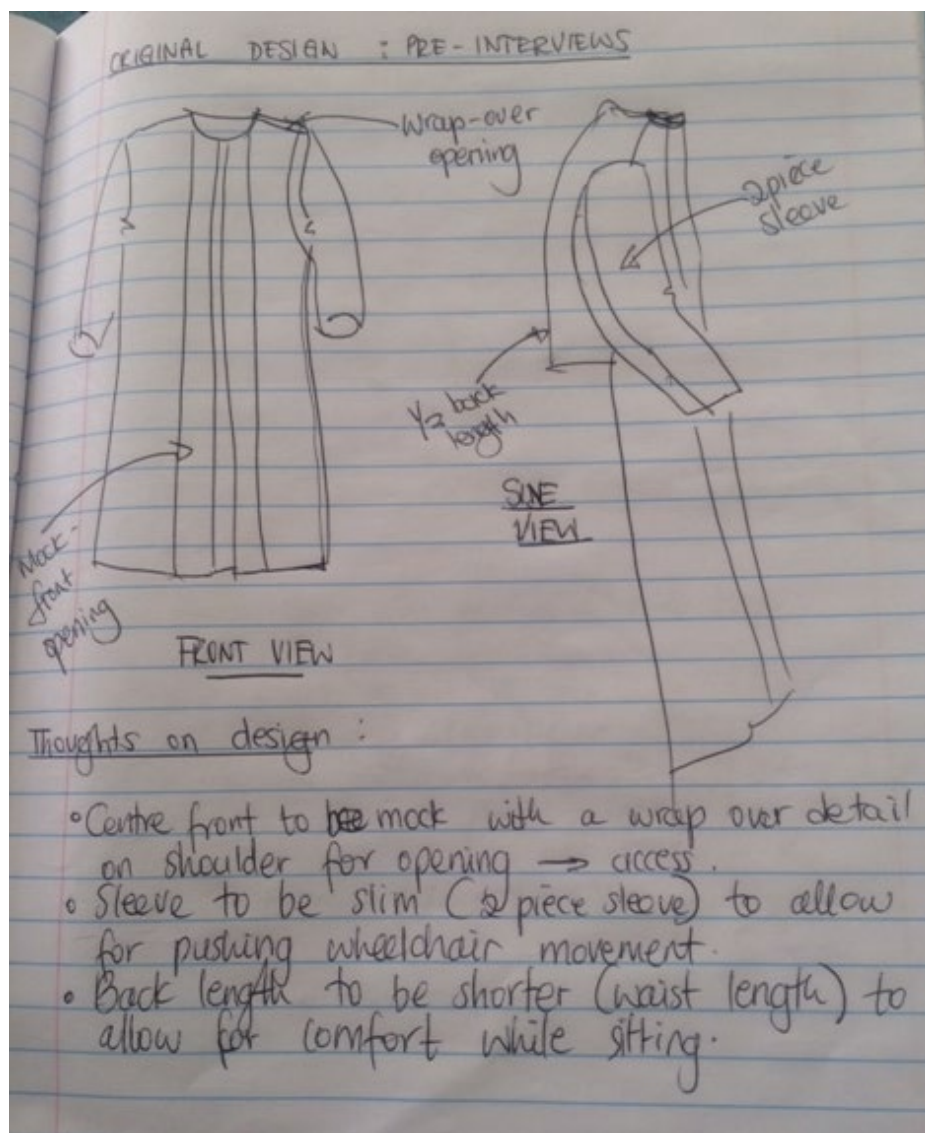


Figure 4.6: Sketch 1 – Original design before the interviews

However, in Figure 4.7 the design changed significantly after the interviews with the differently abled participants, who informed the researcher of the details that needs to be included in the design, to make it inclusive and functional for the manual wheelchair users. Here the centre front of the academic gown is open and functional, with buttons and loop buttonholes on the underside of the centre front, from neckline down to the thigh area, to secure the gown and

keep it from opening when worn. The fit of the bodice to be a closer fit and the silhouette of the garment to have an A-line shape, to allow for the spreading of the lower body when sitting on the wheelchair. The sleeve to be one-piece with a wider upper sleeve to allow for the big arms that develop when one pushes their wheelchair, and a tapered lower sleeve to allow for the safe pushing of the wheelchair. A pattern for the first iteration was developed according to sketch 2 (Figure 4.7).

Figure 4.8 is a digital technical drawing of the sample that was made.

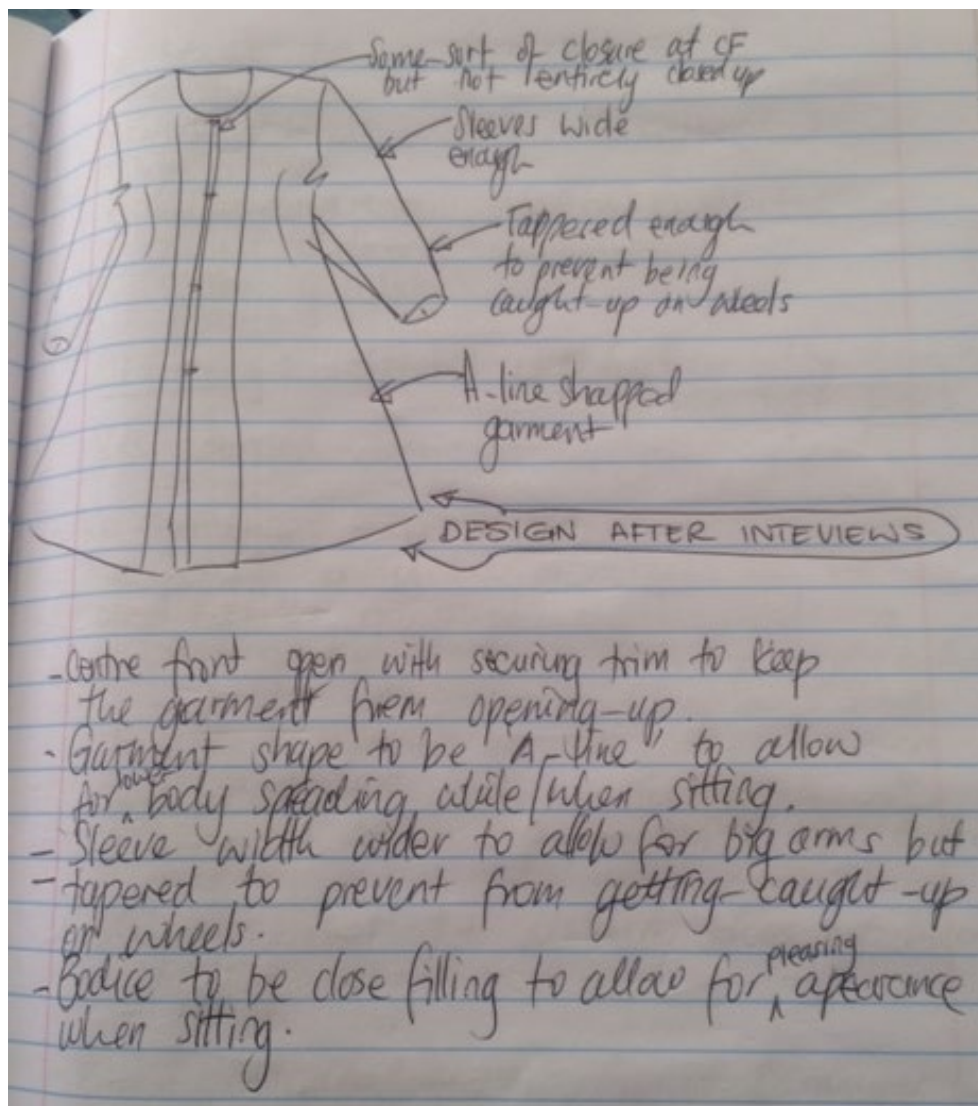


Figure 4.7: Design after the interviews

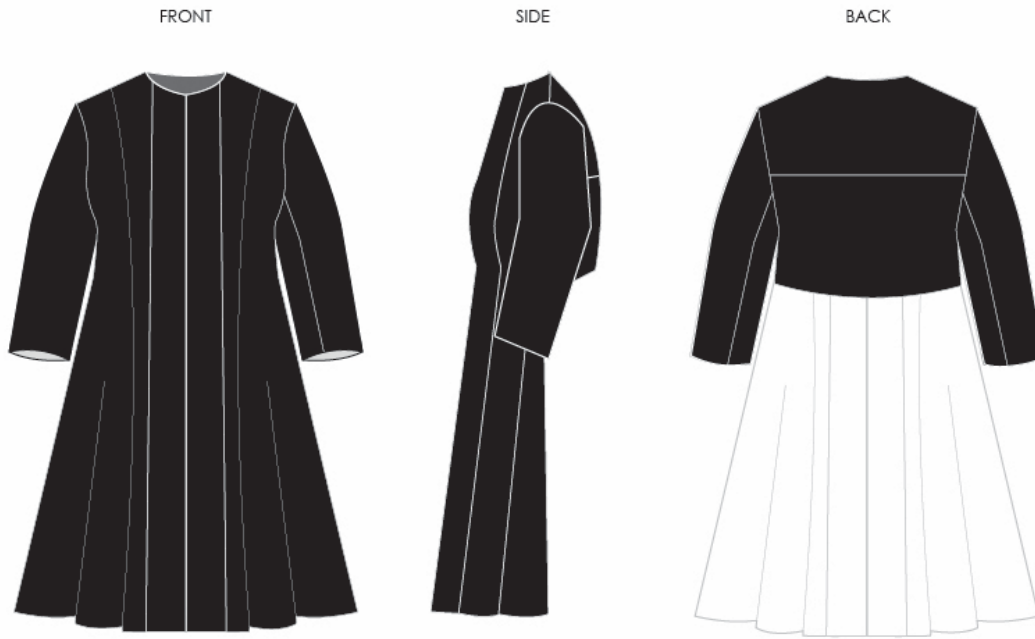


Figure 4.8: Inclusive academic gown (CAD Technical drawing: shorter back)

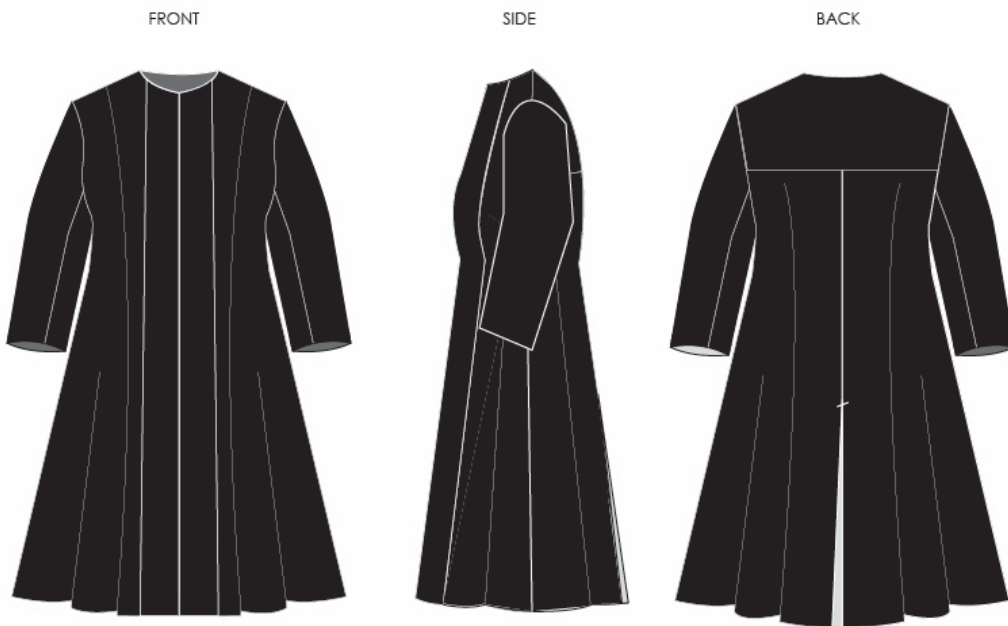


Figure 4.9: Inclusive academic gown, Source (CAD Technical drawing: longer back)



Figure 4.10: Manual pattern making process of the first iteration

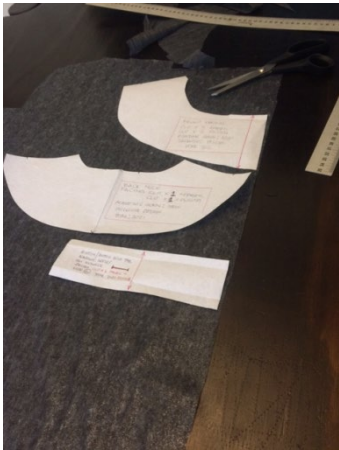


Figure 4.11: Cutting and sewing the first iteration of the inclusive academic gown design



Figure 4.12: Front and back view of the first sample. First fit on the mannequin)

A technical drawing of the inclusive academic gown's shorter back design version is shown in figure 4.8. This was the original design, however it was not until the second iteration stage that the functionality of the garment was changed in response to the user's needs, specifically the ease of access into and out of the garment using Velcro trim, dropped shoulder to the front to allow for a superbly finished neck line, and addition of inverted pleats at front and centre back for ease of movement, see figures 4.10, 4.11 and 4.12. Additionally, the yoke was raised to allow for a slightly broader armhole that is deeper and wider. Figure 4.10 depicts the researcher manually creating the initial iteration's pattern from basic pattern blocks and thereafter styling it to the inclusive academic gown pattern shown in figure 4.9. Figure 4.11 depicts both the manual sewing of the initial iteration's garment and the hand cutting process of this initial garment. The front and back views of the first sample being fitted onto the mannequin are shown in figure 4.12.

The fitting procedure for the initial iteration with one participant in a wheelchair is discussed in table 4.3 below. The seven original UDPs are once again displayed in the first column, followed by the Universal Design Guidelines in the second column, and the changes made to the conventional academic gown to create the inclusive academic gown design while pursuing UDP and guidelines, this is shown in the third column. The final column displays the user P3's spoken comments made during the initial iteration's fitting and feedback session.

Table 4.3: Testing of prototype one with one wheelchair user

Testing of Prototype 1 with one wheelchair user (P3)			
Universal Design Principles	Universal Design Guidelines	Prototype 1: Design	Data extract: Feedback from user
<p>1. Equitable use: Being marketable to people with a wide range of abilities.</p>	<p>1a. Provides the same means of use for all users. 1b. Avoid segregation or stigmatising any users. 1c. Provisions for privacy, security and safety should be equally available to all users. 1d. Make the design appealing to all users.</p>	<p>1. The volume on the sleeve was reduced by changing the sleeve to a non-gathered two-piece sleeve. 2. The gathers on the bodice front and back were removed and the design changed to a plain front and back. 3. The same black colour and fabrication were kept being in line with the rest of the academic dress assortment. 4. The reduced fabric volume assists with less garment weight, especially for people with only one arm (sleeve will be easily tucked in if needed, to prevent accidents).</p>	<p>1. I like the fact that it is not big in the arms anymore. 2. The look of this one is so much better, so much better. It feels better too. 3. Maybe add a little bit of fullness coz now my tummy is showing.</p>
<p>2. Flexibility in use: Individual preferences and abilities are accommodated in a wide range of ways.</p>	<p>2a. Provide choice in methods of use. 2b. Accommodate right- or left-handed access and use. 2c. Facilitate the user's accuracy and precision. 2d. Provide adaptability to the user's pace.</p>	<p>1. The design can be graded into different sizes to accommodate a variety of users. 2. For differently abled users who are still not accommodated in the inclusive academic gown, a custom-designed inclusive gown option can be taken into consideration.</p>	<p>1. This is long for me though. So, this can be made shorter or longer, bigger or smaller if needed? I like that.</p>
<p>3. Simple and intuitive to use: Irrespective of skill/ knowledge level, simple to comprehend.</p>	<p>3a. Eliminate unnecessary complexity. 3b. Be consistent with user expectations and intuition. 3c. Accommodate a wide range of literacy and language skills. 3d. Arrange information consistent with its importance. 3e. Provide effective prompting and feedback during and after task completion.</p>	<p>1. Buttons and buttonholes were added to the inclusive academic gown at the centre front neckline and centre front bodice. 2. Shoulder pads were added to assist with the fit of the garment.</p>	<p>1. Inclusive graduation gown is much easier to don and doff, but I would prefer the back to be shorter so that I don't have to sit on the gown. 2. Now I can push myself while wearing the graduation gown. 3. I would rather prefer to have velcro to close than buttons as I have limited use of my fingers. 4. I like the shoulder pads; they make it look nice and formal.</p>
<p>4. Perceptible information: Despite abilities and other circumstances, efficiently</p>	<p>4a. Provide compatibility with variety to accommodate people with limitations.</p>	<p>1. An option of the custom-designed inclusive gown can be considered for differently abled</p>	<p>1. You know all disabilities are different, people need choice, you</p>

Testing of Prototype 1 with one wheelchair user (P3)			
Universal Design Principles	Universal Design Guidelines	Prototype 1: Design	Data extract: Feedback from user
provides the required information to the user.		users who are still not catered for in the inclusive academic gown.	know this graduation gown will not suit everybody.
5. Tolerance for error: Reduces the risk of unexpected or unintentional actions.	5a. Provides elements that minimise hazards and errors.	<p>1. The volume of fabric used in the body and sleeve design of the inclusive garment was drastically reduced, which also decreased the weight of the inclusive gown. This drastic volume reduction means that potentially dangerous elements were removed from the design when the inclusive academic gown was designed. The inclusive gown is now a safe garment to wear while moving for the user to walk or push themselves in the wheelchair.</p> <p>2. Attaching of trims assist in keeping the academic gown in place while the user s in motion and that prevents it from falling off the shoulders.</p>	1. Now I can now push myself while wearing the graduation gown.
6. Low physical effort: Can be used efficiently and effectively while causing the least amount of strain.	<p>6a. Allow the user to maintain a neutral body position.</p> <p>6b. Use reasonable operating forces.</p> <p>6c. Minimize repetitive actions.</p> <p>6d. Minimize sustained physical effort.</p>	<p>1. No more toiling experienced when donning and doffing the academic gown.</p> <p>2. The user's natural body position is maintained.</p>	1. Everything is balancing now; this graduation gown is not so heavy as the old one.
7. Size/ space for approach and use: Irrespective of body size, posture, or mobility, appropriate size and/or space for manipulation	<p>7a. Provide adequate space for the use of assistive devices/ wheelchairs.</p> <p>7b. Provide flexibility: easy donning and doffing.</p>	1. The inclusive academic gown provides adequate space to allow for easy donning and doffing for mobility-impaired users.	<p>1. I like the fact that it is not big in the arms anymore.</p> <p>2. Inclusive graduation gown is much easier to don and doff, but I would prefer the back to be shorter so that I don't have to sit on the gown.</p>

4.4 Fit & feedback of from user: prototype 1

The analysed data were subsequently used to create the inclusive academic gown, which included determining where UDP could be applied to various portions of the clothing. As far as the geographical location allowed, the fitting and feedback session was conducted with just one participant. The goal of the fitting and feedback session was to get the comments on the universally designed inclusive academic gown, as well as the views, experiences, and impressions. The participant is a wheelchair user and was pleased with the look of the inclusive design and said that it looked improved compared to the one he wore on his graduation day. He was referring to the current conventional graduation gown that is used by the institutions of higher learning in South Africa, see figures 1.1 and 1.2 in Introduction chapter. The fitting session took part in the comfort of his home and his wife assisted with the donning and doffing of the garment during the fit session as the participant has limited movement of his arms due to his injuries.

4.4.1 Evaluate

The first iteration prototype was produced as described in section 4.3 above. The prototype was fitted on one male wheelchair user and the feedback was captured as follows:

1. **Equitable use.** The user reported that “I like the fact that it is not big in the arms anymore. The look of this one is so much better, so much better. It feels better too. Maybe add a little bit of fulness coz now my tummy is showing”.

The look and feel of the garment improved and the reduction of fabric bulk especially on the sleeves makes a significant difference. The actual garment size of the prototype was a bit small for the participant, he wanted more coverage.

2. **Flexibility in use.** The user reported that “This is long for me though. So, this can be made shorter or longer, bigger, or smaller if needed? I like that.”

The actual length of the prototype was too long for the participant, and he preferred it to be shorter. In-fact he would have wanted the back of the garment to be shorter to allow him to remain sited while donning and doffing the inclusive academic gown.

3. **Simple and intuitive.** The user reported that “Inclusive graduation gown is much easier to don and doff, but I would prefer the back to be shorter so that I do not have to sit on the gown. Now I can push myself while wearing the graduation gown. I would rather prefer to have velcro to close than buttons as I have limited use of my fingers. I like the shoulder-pads, they make it look nice and formal.”

The donning and doffing of the inclusive garment improved, however the shorter back inclusive academic gown will work better for him. Movement is no longer restricted, and the fastening trims need to change to Velcro which is easier to close and open.

4. **Perceptible information.** The user reported that “you know all disabilities are different, people need choice, you know this graduation gown will not suit everybody.”
To accommodate all users an option of the custom-designed inclusive gown can be considered for differently abled users who are still not catered for in the inclusive academic gown.
5. **Tolerance for error.** The user reported that “now I can now push myself while wearing the graduation gown.”
The inclusive gown provides elements that minimise hazards and errors. This is owing to the reduction of fabric bulk in the inclusive design allowing freedom of movement.
6. **Low physical effort.** The user reported that “everything is balancing now, this graduation gown is not as heavy as the old one.”
The user’s natural body position is maintained and there is minimum physical effort when wearing the inclusive academic gown.
7. **Size/ space for approach and use.** The user reported that “I like the fact that it is not big in the arms anymore. Inclusive graduation gown is much easier to don and doff, but I would prefer the back to be shorter so that I do not have to sit on the gown.”

The inclusive academic gown provides adequate space for the use of assistive devices/wheelchairs.

In summary the feedback is as follows:

- The reduced fabric volume on the body makes the garment feel lighter in weight as well as look better when worn.
- The reduced volume on the sleeves allows the wearer freedom of movement around the arms. There is no interference of the sleeve volume anymore.
- The hidden attachments are a needed as detail, however, Velcro-fastening will work better than the buttons and buttonholes on the tabs.
- The back length needs to be shorter, the back length to finish around the waist area (personal preference for easy access).
- The shoulder pads on the garment gives it structure.

This is significant feedback as it sets the tone and is the start of a process of inclusivity of differently abled users in academic gowns. This feedback was used as a guide for more design work to enhance the fit and functionality of this inclusive design. The fit session with the participant is depicted in the photographs below. As can be seen in the photographs below, the garment’s size needs to be increased because when worn, the centre front opened.



Figure 4.13: Fitting prototype 1 on the participant

Table 4.4: Second iteration: Implementation of feedback from prototype 1

Implementation of feedback from Prototype 1 fit session into the second iteration			
Universal Design Principles	Universal Design Guidelines	Evaluate Prototype 1: Feedback (P3)	Solutions implemented in Iteration 2
<p>1. Equitable use: Being marketable to people with a wide range of abilities.</p>	<p>1a. Provides the same means of use for all users. 1b. Avoid segregation or stigmatising any users. 1c. Provisions for privacy, security and safety should be equally available to all users. 1d. Make the design appealing to all users.</p>	<p>1. Participants experienced that they liked the reduced volume on the sleeves and body of the inclusive academic gown. 2. The look and feel and fit of the garment are improved. 3. However, there is a need to add a few fullness to the body to accommodate different body shapes without adding too much volume.</p>	<p>1. The yoke of the inclusive garment was dropped to the front to accommodate a clean neckline finish. 2. Inverted pleats were added, one on each side of the front panels and one at the centre back of the bodice to accommodate different body shapes while still maintaining a less bulky garment (subtle fullness added).</p>
<p>2. Flexibility in use: Individual preferences and abilities are accommodated in a wide range of ways.</p>	<p>2a. Provide choice in methods of use. 2b. Accommodate right- or left-handed access and use. 2c. Facilitate the user's accuracy and precision. 2d. Provide adaptability to the user's pace.</p>	<p>1. The participant experienced that the length of the inclusive academic gown is long for him.</p>	<p>1. The length of the academic gown varies as well as the size can be graded into bigger or smaller. In this case two options were made for the second iteration.</p>
<p>3. Simple and intuitive to use: Irrespective of skill/knowledge level, simple to comprehend.</p>	<p>3a. Eliminate unnecessary complexity. 3b. Be consistent with user expectations and intuition. 3c. Accommodate a wide range of literacy and language skills. 3d. Arrange information consistent with its importance. 3e. Provide effective prompting and feedback during and after task completion.</p>	<p>1. The participant experienced that the inclusive graduation gown is much easier to don and doff, but I would prefer the back to be shorter so that they do not have to sit on the gown. 2. They are now able to push themselves while wearing the graduation gown. 3. Would rather prefer to have Velcro to close than buttons as they have limited use of their fingers. 4. Liked the shoulder pads, as their view is that they make it look nice and formal.</p>	<p>1. An option of a design with a shorter back was provided, to accommodate people who prefer the academic gown with a short back. 2. The two-piece sleeve was changed to a one-piece sleeve to further provide comfort around the armhole area of the garment. 3. The buttons and buttonholes were changed to Velcro fastening for ease of closure and opening of the garment. 4. The shoulder pads were kept as an option. The dropped yoke change may require the elimination of shoulder pads.</p>

Implementation of feedback from Prototype 1 fit session into the second iteration			
Universal Design Principles	Universal Design Guidelines	Evaluate Prototype 1: Feedback (P3)	Solutions implemented in Iteration 2
4. Perceptible information: Despite abilities and other circumstances, efficiently provides the required information to the user.	4a. Provide compatibility with variety to accommodate people with limitations.	1. The participant reported that all disabilities are different, therefore people need choice as even this inclusive academic gown will not suit everybody.	1. An option of the custom designed inclusive gown can be considered for differently abled users who are still not catered for in the inclusive academic gown (this will be on request). 2. An option of a design with a shorter back was provided, to accommodate people who prefer the academic gown with a short back.
5. Tolerance for error: Reduces the risk of unexpected or unintentional actions.	5a. Provides elements that minimise hazards and errors.	1. The participant experienced that they could push themselves while wearing the graduation gown.	1. The two-piece sleeve was changed to a one-piece sleeve to further provide comfort around the armhole area of the garment.
6. Low physical effort: Can be used efficiently and effectively while causing the least amount of strain.	6a. Allow the user to maintain a neutral body position. 6b. Use reasonable operating forces. 6c. Minimize repetitive actions. 6d. Minimize sustained physical effort.	1. The participant experienced that everything is balancing now with the inclusive academic gown, the weight of the gown is not so heavy as the old one.	1. Inverted pleats were added, one on each side of the front panels and one at the centre back of the bodice to accommodate different body shapes while still maintaining a less bulky garment (subtle fullness added).
7. Size/ space for approach and use: Irrespective of body size, posture, or mobility, appropriate size and/or space for manipulation	7a. Provide adequate space for the use of assistive devices/ wheelchairs. 7b. Provide flexibility: easy donning and doffing.	1. The participant experienced that they like that the inclusive academic gown is not big in the arms anymore. 2. That the inclusive graduation gown is much easier to don and doff, but I would prefer the back to be shorter so that I don't have to sit on the gown.	1. An option of a design with a shorter back was provided, to accommodate people who prefer the academic gown with a short back.

4.5 Second Iteration: Implementation of feedback from prototype 1 (Alter, Design and Produce Prototype 2)

4.5.1 Technology Station

In the process of creating the second iteration, the researcher outsourced the practical functions of this study to make use of the latest available technology as well as save time. The Technology Station based in the Bellville campus of the university of technology. The Technology station assisted in the drawing the second iteration's technical drawings using the feedback and solutions captured above in Table 4.4. The Technology station created computerised prototypes worn by avatars to show the drape and movement on a three-dimensional view this was done on CLO3D. The process began with the pattern maker creating new patterns digitally on Accumark Computer Aided Design systems. The patterns and prototypes were for both the longer back and shorter back versions of the inclusive academic gown. Below are the pictures of the inclusive garments on 3D avatars (Figures 4.14 and 4.15). Included in the appendices are videos of the avatars walking wearing the inclusive academic gowns both full length and short back version.

Solutions provided were:

1. **Equitable use.** The yoke of the inclusive garment was dropped to the front to accommodate a clean neckline finish. Inverted pleats were added, one on each side of the front panels and one at the centre back of the bodice to accommodate different body shapes while still maintaining a less bulky garment (subtle fullness added).
2. **Flexibility in use.** The length of the academic gown varies as well as the size can be graded into bigger or smaller. In this case two options were made for the second iteration.
3. **Simple and intuitive to use.** The sleeve was changed to a one-piece sleeve to accommodate flexibility. The yoke was dropped to the front chest of the garment. Velcro trim was used as the trim and a shorter back garment was provided as an option.
4. **Perceptible information.** An option of the custom designed inclusive gown can be considered for differently abled users who are still not catered for in the inclusive academic gown (this will be on request).
5. **Tolerance for error.** The two-piece sleeve was changed to a one-piece sleeve to further provide comfort around the armhole area of the garment.
6. **Low physical effort.** Subtle fullness was added by adding inverted pleats one on each side of the front panels and one at the centre back of the bodice to accommodate different body shapes while still maintaining a less bulky garment.

7. **Size/ space for approach and use.** An option of a design with a shorter back was provided, to accommodate people who prefer the academic gown with a short back.



Figure 4.14: back view; front view; back view showing vent detail, side view of the inclusive academic gown (full length design)
(Source: Technology Station, 2022)



Figure 4.15: back view; front view; right hand side view; left hand side view of the inclusive academic gown (short back length design)
(Source: Technology Station, 2022)

Table 4.5: Second iteration – Testing of prototype 2

Testing of Prototype 2 with: one female wheelchair user and an abled-bodied male model				
Universal Design Principles	Universal Design Guidelines	Evaluate Prototype 2: Feedback	Data extract: Feedback from user	Possible solutions: Recommendations
<p>1. Equitable use: Being marketable to people with a wide range of abilities.</p>	<p>1a. Provides the same means of use for all users. 1b. Avoid segregation or stigmatising any users. 1c. Provisions for privacy, security and safety should be equally available to all users. 1d. Make the design appealing to all users.</p>	<p>Length of the full academic gown needs to be shorter. Armhole a bit tight on the full-length garment.</p>	<p>“It’s too long, can it be shortened?” “Also, it’s a bit tight around the arms”.</p>	<p>Shorten the length of the longer inclusive academic gown to prevent it being a tripping hazard when worn. Drop armhole to open and adjust it so that it may fit better.</p>
<p>2. Flexibility in use: Individual preferences and abilities are accommodated in a wide range of ways.</p>	<p>2a. Provide choice in methods of use. 2b. Accommodate right- or left-handed access and use. 2c. Facilitate the user’s accuracy and precision. 2d. Provide adaptability to the user’s pace.</p>	<p>The option to have a shorter back or a longer back provides choice to the users according to their needs.</p>	<p>“I like the shorter back garment”.</p>	<p>Offer choice to the user; a shorter back inclusive academic gown as well as the full length inclusive academic gown.</p>
<p>3. Simple and intuitive to use: Irrespective of skill/ knowledge level, simple to comprehend.</p>	<p>3a. Eliminate unnecessary complexity. 3b. Be consistent with user expectations and intuition. 3c. Accommodate a wide range of literacy and language skills. 3d. Arrange information consistent with its importance. 3e. Provide effective prompting and feedback during and after task completion.</p>	<p>The reduction of fabric volume assists in having a more manageable garment and eliminates complexity.</p>	<p>“It’s not exhausting to wear it, it’s manageable.”</p>	<p>Moving the positioning of the inverted pleats at front to be where the seam is as well as changing the centre back box pleat to an inverted pleat.</p>
<p>4. Perceptible information: Despite abilities and other circumstances, efficiently provides the required information to the user.</p>	<p>4a. Provide compatibility with variety to accommodate people with limitations.</p>	<p>Offering different designs assist in accommodating people with limitations.</p>	<p>“I like the shorter back garment”.</p>	<p>Provide choice to the user: Longer/ full length garment, shorter back garment, an option to have custom-made garment for users whose body needs are</p>

Testing of Prototype 2 with: one female wheelchair user and an abled-bodied male model				
Universal Design Principles	Universal Design Guidelines	Evaluate Prototype 2: Feedback	Data extract: Feedback from user	Possible solutions: Recommendations
				not accommodated in the inclusive garment.
5. Tolerance for error: Reduces the risk of unexpected or unintentional actions.	5a. Provides elements that minimise hazards and errors.	Adjustments must be made to eliminate the bottom of the shorter back garment from touching the wheels.	“The garment is touching the wheels and may get caught.”	Solution here is to shorten the back by 10 to 12cm so that the front starts a bit higher at side seam, the Velcro trim will need to extend to the lower part of the centre front to keep the lower part of the garment closed and away from the wheels.
6. Low physical effort: Can be used efficiently and effectively while causing the least amount of strain.	6a. Allow the user to maintain a neutral body position. 6b. Use reasonable operating forces. 6c. Minimize repetitive actions. 6d. Minimize sustained physical effort.	Low physical effort needed when wearing the shorter back inclusive academic gown.	“I don’t struggle when I put on the shorter back garment.” “The physical labour of wearing this longer graduation gown is too much.”	It may be a better option to choose the shorter back option of the inclusive academic gown for wheelchair users whose physical movement is extremely limited.
7. Size/ space for approach and use: Irrespective of body size, posture, or mobility, appropriate size and/or space for manipulation	7a. Provide adequate space for the use of assistive devices/ wheelchairs. 7b. Provide flexibility: easy donning and doffing.	Inclusive academic gown allows enough space for donning and doffing.	“It’s not bulky anymore, so it’s now easy to wear the graduation gown.”	Add Velcro trim at centre front from top to bottom to ensure the inclusive academic gown stays closed.

4.6 Fit & Feedback: Evaluate Prototype 2

4.6.1 One abled body participant

Full length academic gown

- The garment fitted well, and the model liked that the inclusive academic gown sample had less fabric volume on both the sleeves and the body.
- Some adjustment needs to be made to the armhole of the garment as it felt a bit tight.
- The length of the garment needs to be shortened.
- Overall, the model was happy with the general fit of the garment.



Figure 4.16: Fitting prototype 2 on an abled body participant

4.6.2 One differently abled participant: female wheelchair user

Shorter back inclusive academic gown

- Participant was excited to see and fit this as she could dress herself with minimal assistance from her mother. It took a few minutes for her to wear this garment.
- Participant was incredibly happy about the shape and fit of the sleeves, however the sleeve length needs to be slightly longer.
- The front bottom of the garment opens badly and flaps to the wheels of the wheelchair (solution here may be to shorten the back by 10cm to 12cm so that the front starts a bit higher at side seam, the Velcro trim will need to extend to the lower part of the centre front to keep the lower part of the garment closed and away from the wheels).
- The inverted pleat must move to the front seam area.
- The centre back box pleat looks good; however, it needs to change to an inverted pleat to keep the same look as the front of the garment.



Figure 4.17: Fitting prototype 2 (shorter back) on a wheelchair user participant

Longer back inclusive academic gown

- Participant struggled to put the garment on. She had to move to the table where she had to pull herself up by placing her hands on the table and pushing her body up while her mother tucked the garment underneath her lower body so she could sit on it. She was not happy with the amount of struggle involved in putting this garment on.
- The sleeve was tight (solution here is change it to the same sleeve shape as the shorter back sleeve).
- The Velcro trim needs to go all the way to the bottom section of the garment to assist with keeping the centre front in place.
- The inverted pleat must move to the front-seam of the garment.
- The centre back box pleat looks good; however, it needs to change to an inverted pleat to keep the same look as the front of the garment.



Figure 4.18: Fitting prototype 2 (full length) on a wheelchair user participant

Following the fitting, additional changes were made, as seen in figures 4.17 and 4.18. The wheelchair user's feedback in section 4.6's user comments served as inspiration for these improvements. These adjustments are shown in the technical drawings below for both the long and short back garments. The subsequent changes were made: The inverted pleats on each front panel were left in place, and the seam lines were removed. The garment length is 20 cm shorter for the full-length design. To prevent the front panels' sides from hitting the wheelchair's wheels, the shorter back garment's rear length was further shortened, as seen in figure 4.18. The sides of the front panels were scooped slightly to provide additional protection from the garment contacting the wheels of the wheelchair. Finally, the centre front of both inclusive gown designs had Velcro trim added.

4.6.3 Technical drawings of graduations gowns

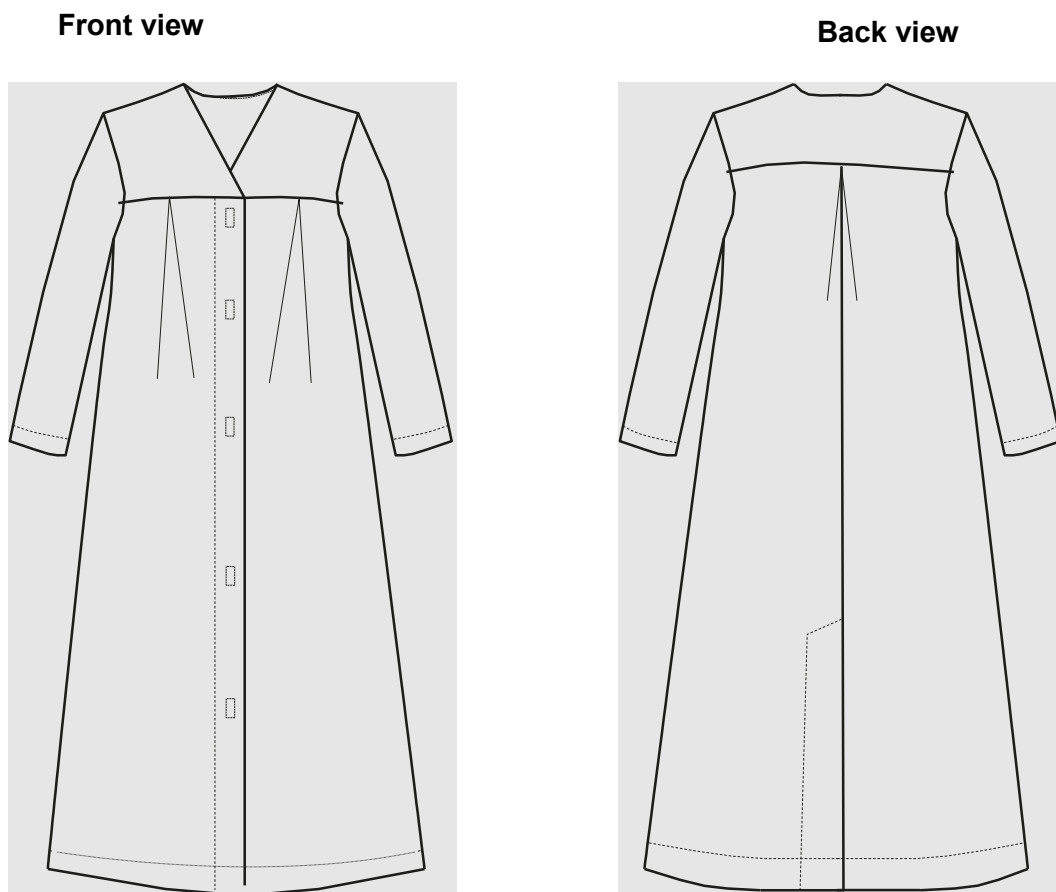


Figure 4.19: Graduation Technical Drawing 1

Notes:

- Graduation gown has a doubled one-piece yoke.
- Graduation gown has a one-piece sleeve.
- Graduation gown has inverted pleats at both the left and right front and centre back.
- Graduation gown has a velcro opening at the centre front.
- Velcro length is 4cm and 2cm in width.
- Graduation gown has a vent opening of 42.5cm.

Figure 4.20: Technical drawing after fitting session (full length)

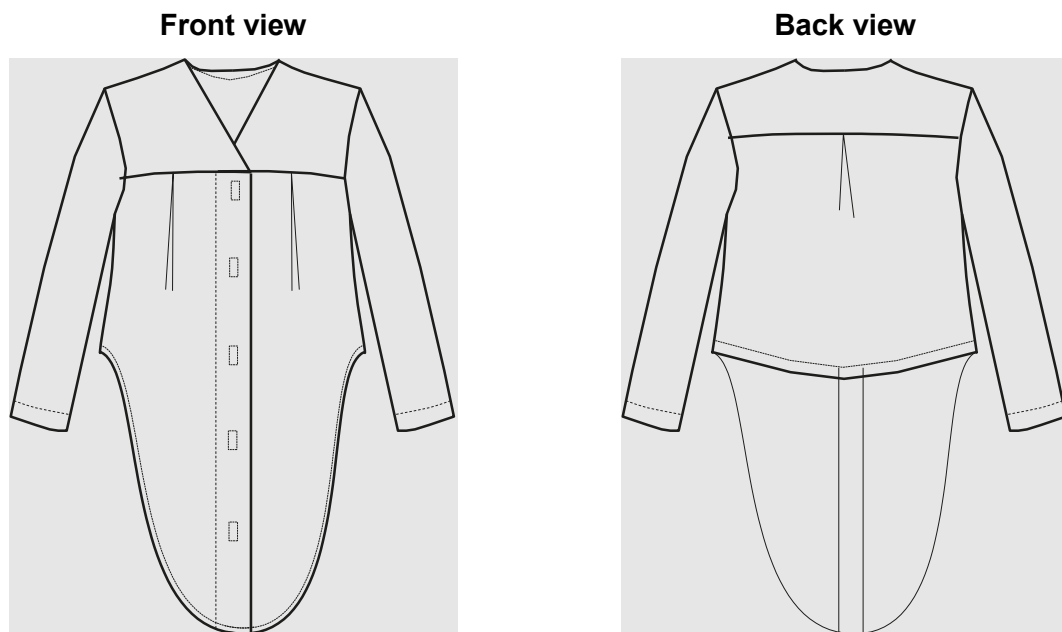


Figure 4.21: Graduation Gown Technical Drawing 2

Notes:

- The graduation gown has a doubled one-piece yoke.
- Graduation gown has a one-piece sleeve.
- Graduation gown has inverted pleats at the front and centre back.
- Graduation gown has a velcro opening at the centre front.
- Velcro length is 4cm and 2cm in width.
- The distance between the velcro is 14.5cm.
- The graduation gown is shortened at the side seam.
- The graduation gown has a cropped back.

Figure 4.22: Technical drawing after fitting session (shorter back length)

4.7 Photoshoot

According to the process diagram Figure 4.5 and the technical drawings in Figures 4.19 and 4.21, this section depicts the fitting session of the third iteration. This session involved the fitting and photography of three academic gowns. The conventional academic gown is the first type, and it is currently provided by most South African institutions of higher learning. Graduands wear this graduation gown during graduation ceremonies. Figure 4.25 shows the full length inclusive academic gown, which was the second one to be fitted, and Figure 4.26 shows the shorter back length inclusive academic gown.

All these garments were fitted on a mobility impaired participant who is a wheelchair user. The experiences were vastly different when these garments were fitted these experiences will be described below.

4.7.1 Conventional academic gown

The participant needed two people to help her done the conventional academic gown, lift her out of the wheelchair, and hold her up while the second person pulled the garment and tucked it under her lower torso and legs. She was able to wear it, but it was a difficult exercise to carry out because of how heavy the garment was. The participant could not push herself since the sleeves of the conventional gown were too wide and would catch in the wheels, so she had to be pushed from one place to another. The body of this garment was also problematic because it was impossible for the participant to move without risking having their body slide to the side and becoming entangled in the wheels of the wheelchair. The participant had to be helped up

by one person while the other took off and pulled out the traditional gown, thus donning this garment was also a mission. By the time the participant finished fitting the conventional gown, they were exhausted and needed a break before moving on to fitting the following item.

Figure 4.23 shows images of the participant wearing the conventional academic gown.



Figure 4.23: Conventional gown fitting and photo shoot session.
(Photographer: Smith, 2022)

4.7.2 Full length inclusive academic gown

The experience donning and doffing of the full length inclusive academic gown was slightly different from the conventional academic gown, in that the participant commented on the lighter weight of the garment and how that made a difference when she was wearing it. When donning this garment, she still needed the assistance of two people, one help her put on the garment, pick up from the wheelchair and hold her up while the other tucked the garment under her lower body and legs. This time around she was able to push herself from one point to the next as the sleeve of the inclusive academic gown was not wide but just a normal width insert sleeve. The fit of the garment on the upper body was good however, the velcro at the centre front of the garment opened on the lower body as she sat on it. The centre front of the inclusive garment was secured with Velcro fastening, this helped with keeping the garment secured when the participant moved. The pictures of the longer length inclusive garment are below (Figure 4.24).



Figure 4.24: Full length inclusive academic gown fitting and photo shoot session
(Photographer: Smith, 2022)

A person without mobility impairments was fitted with the identical full-length academic gown to test if it would work for them. The participant was a shorter person in height; thus, the garment would need to be trimmed despite the good fit and good length. He said he would wear it to graduate if it were a possibility because everything fit well, and he appreciated the way it looked. The fitting session is depicted in the photos below (Figure 4.25).



Figure 4.25: Full length inclusive academic gown fitting and photo shoot session

4.7.3 Shorter back inclusive academic gown

Fitting this garment was a pleasure to the participant. The excitement expressed when she saw this was so fulfilling to witness. She donned and doffed the garment with hardly any assistance. There was no need for her to be picked up and held up, no need to tuck the garment under her lower body and legs as the back of the garment was shorter and stopped on the waistline. The weight of the fabric used was also lighter than that of the conventional academic gown she fitted earlier. The sleeves were narrow with less volume on the body and shaped lower front of this garment the Velcro fastener were kept in place and the garment remained closed throughout. She looked and felt good in this garment, and she enjoyed wearing it. Her testimony and experience are capture on video as well as the video of the donning and doffing process, these will be included with appendices of this study. The experience of participant wearing this garment was not only heart-warming but dignifying and empowering on her part as she was able to dress herself and push herself while wearing the shorter back inclusive gown. Below are pictures of the participant wearing the inclusive shorter back academic gown.



Figure 4.26: Shorter back inclusive academic gown fitting and photo shoot session
(Photographer: Smith, 2022)

4.8 Conclusion

The process of data analysis was thoroughly described in this chapter. Using UDPs to guide the application of thematic analysis to extract codes from the collected data and themes from the identified codes. The practical design process from the first iteration through the third iteration, including the fitting and feedback sessions where three different academic gowns were fitted by participants who had mobility impairments, apart from one garment, the full-length inclusive academic gown, which was fitted on participants who were able-bodied as well. The

conventional academic gown, the full-length inclusive academic gown, and the shorter back inclusive academic gown were the items that were fitted. The findings and conclusion will be informed by all the information presented in this chapter.

Chapter 5: Conclusion and Recommendations

5.1 Introduction

The preceding chapters of this study addressed the problem in this study. The problem with the absence of inclusivity of mobility impaired persons in academic dress, specifically the academic gown. This chapter covers the summary of this research, followed by the discussion of the findings and lessons learnt from the research. Finally, recommendations for both further research and policy making and practice.

5.2 Summary

Chapter 1 discussed the issue of graduands with mobility impairments not being included in academic gowns. This chapter briefly looked into the background of the conventional academic gown. The history demonstrates that not much has changed in the academic gown's design from its original conception in the 1490s to accommodate the variety of wearers, including those with disabilities (McCallum, 2005). To this point the study was deemed necessary, and it was important to include real life experiences. It is from this position that the findings in section 5.3.1 below are outlined.

This research was conducted using research questions and a research design that was outlined in the first chapter. This qualitative study described an approach that deals with the experiences of people, and this helped the researcher to understand what is significant to the study's sample group, namely the differently abled community for the purpose of this study (Silverman, 2016). Furthermore, qualitative research gives attention to the individual and inimitable experiences of the participants (Billups, 2019). This was the case in this study, it depended on the narrated experiences of the users to address the problem.

It is important to remind the reader of what was covered in the first chapter and review the research questions of this study, to see if they were answered in the data analysis. The research problem statement and the research questions captured in the first chapter of this study follows.

5.2.1 Research problem statement

Institutions of higher learning take responsibility for fully integrating all people into society at large (Dalton et al., 2019). This also implies that policy-level consideration of the UDPs (UDPs) filter down to teaching and learning, building access, and residential spaces. To assure simplicity of use, Ron Mace introduced UDPs in the 1980s. These principles can be applied to a variety of sectors of life, including building, signage, furniture, and transportation (Null, 2015). However, there is still work to be done to ensure inclusivity and equity in all aspects of functioning in

institutions of higher education learning. There is minimal evidence to suggest that inclusion in academic dress is addressed in the institutions of higher learning in South Africa.

No matter their physical ability or impairment, all people should have access to clothing that fits properly and is comfortable. Research demonstrates that this is currently untrue. While little to no attention is paid to clothing that provides comfort to the wearer, differently abled people face problems with unpleasant clothing items. When sitting, which is a common position for people who are confined to sitting because of their impairment, clothing should still be comfortable (Nakić & Bogović, 2019). Differently abled people may not be able to participate completely in social activities, relationships, jobs, and daily activities if they do not have access to appropriate and comfortable attire.

Additionally, it has been demonstrated that these limitations may have an impact on a person's emotional health (Ayachit & Thakur, 2017; Kabel et al., 2017). With the aid of key role models in the apparel business, such as fashion designers, this might be improved. As the current design utilised in higher education institutions does not reflect the inclusivity of all who use it, it may be claimed that academic dress is still far from assuring the inclusion of all users.

As more practical clothing pieces were developed over time, clothes grew less difficult and heavy (Das Neves et al., 2015). Since it was first worn in Italy and France in the late 11th and early 12th centuries, academic attire has not yet undergone meaningful change. (McCallum, 2005). This indicates that in South African institutions of higher learning, the inclusion of differently abled individuals in the design of the academic clothing has not yet occurred in terms of the design, functionality, practicality, comfort, and fit.

5.2.2 Primary research question

The main (primary) research question is formulated as follows:

PRQ: How can Universal Design Principles be adopted for the design of inclusive academic dress for differently abled persons?

Findings suggest that UDPs can be adopted to the design of the inclusive academic dress for differently abled persons. This was accomplished through a step-by-step process where the data collected from the users were arranged and worked through using the seven UDPs and Guidelines, where each guideline provided a thorough guide to the design of the inclusive academic gown as demonstrated in Tables 4.4 and 4.5 in Chapter 4.

5.2.3 Research sub-questions

RSQ 1: How do differently abled persons experience the wearing of conventional academic dress?

The data collected indicated that graduands who are differently abled, experienced a range of emotions when wearing the conventional academic gown, including excitement, pride, and a sense of accomplishment, as well as physical difficulties brought on by the conventional academic gown's design. This is showed in the challenges and needs assessment (Table 4.1 in Chapter 4).

RSQ 2: To what extent can the application of UDPs to the design of academic dress contribute to an improved graduation experience?

The UDP guided the design of the inclusive academic gown from concept stage, design, sampling and the fitting and feedback of all three iterations of the inclusive academic gown. UDP were the base of the entire process described in the preceding sentence. The concept stage was the interview stage where participants shared their experience and the data were analysed as demonstrated in Chapter 4, sections 4.1 and 4.2. The data highlighted, that the conventional academic gown promotes segregation, it does not accommodate mobility impaired people and those with unique body types, it promotes unnecessary toiling to mobility impaired users and gives a sense of mixed emotions to mobility impaired users.

This information assisted the design and sampling stages where the needs captured in the themes were addressed in the design of the inclusive academic gown. Here two versions of the inclusive academic gown were produced one full length garment and the other a shorter back garment, see sections 4.3 and 4.5. The last stage was the testing of the prototypes where the participant gave feedback about the fit of the inclusive academic gown on all three iterations, the feedback was evaluated and aligned with the UDP thereafter actioned on the next iteration, this fitting and feedback process is shown in sections 4.4 through to 4.7. The final iteration served as the final product of the study and is shown in section 4.7. UDP guided the design of an inclusive academic gown through-out from the beginning until the end.

5.2.4 Research aim

The primary aim of this research was to develop a suitable and inclusive academic dress design for differently abled persons, an inclusive academic gown, as well as contribute to best practices for inclusivity in the institutions of higher learning in South Africa and the field of fashion, specifically the academic dress.

5.2.5 Research philosophy

This study adopts an interpretivism methodology, which Elster (2007) defines as emphasising people's authenticity and participation in social and cultural life. This viewpoint, on which this investigation is based, is shared by the researcher. Participants were afforded space to freely share their experiences of graduation day during interviews.

Interpretivism encourages the use of qualitative data in the search of knowledge, according to Kaplan and Maxwell (1994; Myers, 2017). This is especially true in the case of this study because the researcher was able to appreciate the demands of the participants, who serve as representatives of the greater population of students with mobility impairments enrolling in institutions of higher learning. While interpretive research provides context for a study, critiques frequently question the impartiality and reliability of its findings (Perry, 1998). However, in the case of this study the researcher was able to understand the needs of the participants, who serve as representatives of the larger population of mobility-impaired students enrolled in institutions of higher learning in South Africa.

The second chapter looked reviewed the literature related to this study, in order to unpack what has already been written about this subject. The history of academic dress was explored and shared in this chapter, where it may be assumed that differently abled persons were not the people whom the conventional academic dress was designed for, particularly the gown. In principle, any object worn by humans should be created to match the user's physical measurements (Louw & Radder, 1999). The correct size goes a long way in ensuring comfort and fit of the garment when worn by the user. In addition, the second chapter also investigated the state of the institutions of higher learning in South Africa.

In this section several issues were discussed including the fees must fall protests that took place in the South African institutions of higher learning over a few years. Here, students demanded several things including free education and the decolonising of the higher education systems to be in tune with the needs of the student of today in the democratic South Africa. These protests happened countrywide forcing teaching and learning to come to a stand-still, this is the time when the #Fees-Must-Fall movement started (Ludski, 2015). At the same, a symbolic fall of colonialism happened when the council of the University of Cape Town voted for the eradication of the statue of Cecil John Rhodes on the 9th of April 2015 (Rhodes Must Fall, 2015). Inclusivity in the institutions of higher learning was also discussed in this chapter.

The terminology describing persons with disabilities used in this study as well as other terminology used in society as out lined by literature was unpacked. Differently abled is the term used in this study. It takes the concept of placing the individual first a step further by emphasising the person's ability rather than their disability. Suharto et al. (2016) states that this

phrase highlights a positive aspect of persons with disabilities and serves as a helpful reminder of the need of highlighting strengths and respecting differences. Recently, the term “disabled” or “disability,” which refers to having different abilities has also begun to be used (Suharto et al., 2016). The American Psychological Association (APA) (2015) recommends that when identifying differently abled people, the principle of putting the person first and then the impairment is best practice. Instead of saying “disabled person/people”, use the term “differently abled” (APA, 2015 This is done to promote a culture of respect while writing about individuals with disabilities (Dunn & Andrews, 2015).

Engagement highlighting the graduation ceremony as a social event that is significant in a student’s life, since it signifies the conclusion of their academic career and their accomplishment therein. Due to a variety of factors, including clothing-related difficulties, a large number of differently abled people frequently choose not to attend their graduation ceremony. Chapter 2 also included a thorough overview of Universal Design’s Principles and Guidelines as well as accessibility in design. The second chapter’s conclusion acknowledged Universal Design as the study’s theoretical foundation.

Chapter three covers the methodology used in the research. A qualitative study, using a practice-based approach to explore the needs of the sample group. In practice-based research, an artefact takes on the role of the study’s main contribution. Candy (2006:3) claims that practice-based research (PBR) is an original investigation done to gather new knowledge [partially] using activity and the outcomes of that practice. According to Candy, “this kind of research has led to new concepts and methodologies in the creation of original knowledge. Research is practice-based if a creative artifact serves as the foundation for a contribution to knowledge” (Candy, 2006:3).

Chapter 4 unpacked and showed the thematic analysis process that was followed for data analysis as well as showing the practical iteration process on the inclusive academic gown. This practical process consisted of three iterations of designing, sampling and fitting, and feedback sessions about the inclusive academic gown. The whole process is explained step by step and pictures showing the process as it unfolded are provided in Chapter 4. The data coding process as well, development of codes related to theme is clearly explained and demonstrated with screenshot examples.

5.3 Discussion of the findings

5.3.1 Methodological reflections

The purpose of this study was to determine whether there is a necessity for inclusive academic gowns that are appropriate for all users, including those with mobility impairments, as well as whether and how the principles and guidelines of Universal Design can be used as a tool to

guide the process of designing inclusive academic gowns. Only by first knowing the experiences of the graduands who wore the conventional academic gown and giving them the chance to share their stories, was it possible to access this information. The acquired data were then analysed for possible answers to the research questions. The intense data analysis in the previous chapter, revealed the necessity for an inclusive academic gown that people with mobility impairments might wear on their graduation day. These results provide an overview of how the Universal Design Principles were applied as a vehicle to steer the process towards the identification of themes, which in turn led to the design of the inclusive academic gown.

Graduands with various abilities are a part of the diverse community that exists within institutions of higher learning. Differently abled classification includes a variety of disabilities, however, for this study, the focus was on those with physical mobility disabilities who use a wheelchair, walking aid objects, or perhaps another type of medical shoe. In this study these graduands were allowed to discuss their experiences after having previously graduated. For the researcher to accurately capture the participants' experiences of the period leading to graduation and graduation day, it was crucial to allow the participants to revisit the events.

Five differently able persons participated in this study. Each had limitations of movement. Online, semi-formal interviews were conducted using Microsoft Teams and Zoom platforms. Before the interviews, the researcher obtained both verbal and written consent from each participant. Ahead of the interviews, participants were given a few questions to consider. These were questions regarding personal physical and emotional graduation experiences as well as their suggestions for what design elements to keep or remove from the creation of an inclusive graduation gown. It was up to the participants to narrate their own stories as they remembered them. The conversation was guided by the questions to stay on topic and avoid deviating from the study's scope. Every interview was captured on video. Each interview was different in length; some were longer than others. No two interviews lasted the same amount of time.

Transcription

Transcribing was done manually by the researcher. No alterations were made to the participant's verbal expression; the interview tapes were watched and completely transcribed. No information was modified; the interviewer sought to convey the participants' perspectives exactly as they were. The five interviews lasted a total of three hours, and 42 minutes. The interviewer had to manually transcribe every interview and record it in writing, which took thirty-one days. The interviewer was reminded of all the conversations and points of view that were discussed during the interviews, which required several hours of laborious yet rewarding work.

The researcher's ability to analyse the data and discover recurring themes was aided by the transcription process. On request, the interviews' transcriptions can be made available.

Participant 1

The first interview was conducted with a middle-aged (exact age withheld) male from Pretoria, Gauteng. It was conducted on Microsoft Teams. When he received his first higher education credential in 1999, he had his first experience with a real graduation ceremony. He identified himself as a reader, writer, and thinker. He uses only one hand, is in a wheelchair, and has mobility limitations. Although he holds several further degrees, including two master's degrees, he chose not to attend the graduation ceremonies for the other degrees for some reasons, which he discussed in the interview.

Participant 2

A male participant from Cape Town, aged 44, was the second participant. On Microsoft Team, an online interview was conducted. His spinal injury from post-polio is the cause of his impairment. He has limited mobility and walks with the use of crutches. He graduated from the University of the Western Cape with a BCom in Communication in 2003. Due to his ability to walk, his graduation experience was somewhat different from the first participant's.

Participant 3

The third participant was a man, age 43, from Cape Town. The interview was conducted using Microsoft Teams online. His condition was due to a diving accident 29 year ago, that left him paralysed from the neck down. He operates the joystick on a battery-operated wheelchair to move in any direction. He graduated from Cape Peninsula University of Technology with a degree in public management in 2005.

Participant 4

The fourth participant was a female, age 53, from Johannesburg in Gauteng province. The interview took place online using Zoom technology. She graduated from the University of the Western Cape in 1997 with a B.Admin. and the University of Johannesburg in 1998 with a B.Com. with Honors in Industrial Psychology. She is defined as an incomplete quadriplegic with limited use of her legs due to a spinal cord injury. She moves about in a wheelchair. She has wheelchairs that are both manual and powered by batteries. She only had a manual wheelchair at the time of her graduation, which required her to move with her hands.

Participant 5

A male participant, age 32, from Cape Town was the fifth participant. His impairment is on his left foot has movement challenges due to a rectified clap foot. He can walk without the use of crutches or a wheelchair, but because his left leg is shorter than his right, he must wear special shoes. He can't run because of this, and it affects the way he walks. He graduated with a BTech in civil engineering in 2017 and is currently enrolled in a master's program in the field. After working through the data collected from the five participants above, codes were identified for each of the seven UDPs. From the identified codes the data were organised into themes with some codes merging into one theme. The following table shows the identified themes that led to the design and the practical iteration process of the inclusive academic gown, outlined in the previous chapter.

5.3.2 Seven conclusions that were a result of this research

Table 5.1: UDPs, themes and solutions

Universal Design Principles	Themes	Solutions: Inclusive Academic Gown
1. Equitable use	The conventional academic gown promotes segregation and does not appeal to all users.	A simpler, ergonomically designed inclusive academic gown was designed.
2. Flexibility in use	The conventional academic gown lacks choice and does not accommodate mobility impaired users as well as people with extreme body shapes.	Inclusive academic gown addressed key issues identified in the conventional gown including, having an option to grade into different sizes to accommodate extreme body shapes, provide an option of a longer or shorter back inclusive academic gown. Providing an option to have a custom-made academic gown for people whose body requirements are still not accommodated in the inclusive gown.
3. Simple and intuitive to use	The conventional academic gown promotes unnecessary complexity and does not meet the user's expectations and intuition.	Inclusive gown eliminated unnecessary complexity on the garment.
4. Perceptible information	The conventional academic gown does not provide compatibility with variety to accommodate people with limitations.	The inclusive academic gown options give the user a choice to have a garment that will suit their body requirements.
5. Tolerance for error	The conventional academic gown has elements that promotes potential hazards to mobility impaired users. The conventional academic gown promotes a disabling environment for mobility impaired persons.	Inclusive academic gown eliminated elements that promoted hazards to mobility impaired users. Inclusive academic gown/ gowns may promote positive emotional and physical graduation day experience.
6. Low physical effort	The conventional gown promotes unnecessary toiling.	The inclusive academic gown eliminated unnecessary toiling.
7. Size/ space for approach and use	The conventional academic gown does not provide flexibility to make	The inclusive academic gown addresses the challenges

	donning and doffing the garment easy.	experienced in the process of donning and doffing.
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The themes captured in table 5.1 address the primary and sub questions of this study through the guidance of the UDPs. The following are the identified themes of this study.

Theme 1: The conventional academic gown promotes segregation and does not appeal to all users

The findings showed that because mobility-impaired people did not have a choice in academic gowns, they were required to wear the conventional academic gown, which was the only option offered to all graduates, even if it was unsuitable for their bodies and mobility situations.

Theme 2: The conventional academic gown lacks choice and does not accommodate mobility impaired users as well as people with extreme body shapes

According to the data, the traditional academic gown was only appropriate for abled bodied users and did not accommodate persons with extreme body types, such as dwarfism, very tall people, and those without limbs.

Theme 3: The conventional academic gown promotes unnecessary complexity and does not meet the user’s expectations and intuition

According to the data, different users for whom the weight of the conventional academic gown may be a challenge due to a variety of factors, such as having only one arm or a small frame where the garment falls off the shoulders while being worn, are not accommodated.

Theme 4: The conventional academic gown does not provide compatibility with variety to accommodate people with limitations

The data demonstrated that wheelchair users who rely on their hands and arms to propel the wheelchairs to move about are at a disadvantage due to the lack of options in academic gown. Users who already have physical limitations due to their mobility impairments face additional barriers due to the bulk in the design of the conventional academic gown.

Theme 5: The conventional academic gown has elements that promotes potential hazards to mobility impaired users. The conventional academic gown promotes a disabling environment for mobility impaired persons

The data confirmed that the bulk on the sleeve and the body of the conventional academic gown prevents a user who is mobility impaired from pushing himself because the sleeves and the bulk on the body of the garment get caught on the wheels.

Theme 6: The conventional gown promotes unnecessary toiling

According to the data, users who use crutches must exert more effort when wearing the garment to try to keep it in place since it slides off the body when they move because there is no option for a trim to secure the conventional academic gown at the centre front neck and body of the garment.

Theme 7: The conventional academic gown does not provide flexibility to make donning and doffing the garment easy

According to the data, users had only one option for academic gowns due to a lack of options, and those who use wheelchairs must enlist help from others to don and doff the conventional academic dress due to the bulkiness of the garment.

The solutions that were applied to address each of the themes in accordance with each of the seven UDP to facilitate the designing and fitting of the inclusive academic gown are also shown in Table 15.1.

The following table outlines the implications of research choices made for this study as well as the advantages.

Table 5.2: Implications of research choices made in this study

Research choice	Advantage	Disadvantage	Implications
Individual interviews	<ul style="list-style-type: none"> • Privacy • Time restriction: little to none 	Interviews conducted after hours and/ weekends	Lengthy interviews
Online interviews	No travelling necessary	Interviews had to be scheduled outside load shedding periods	Load shedding times not aligning
Fitting one wheelchair user: 1 st iteration	Geographical location was in the same city as the researcher	Limited feedback	More iterations were necessary
Use of the Technology station for pattern making and sampling	Time was saved		
Working with the participant size rather than individual measurements	The inclusive design was not designed for an individual rather for a broader spectrum of users	Garment was long on sleeves and length	Sleeves needed shortening as well as the hem

The choices made for the research, which are shown in the table above, ensured that the process went as smoothly as possible. For instance, the initial plan for interviews following the proposal stage was to facilitate focus groups. However, this plan was suspended because it proved difficult to convene everyone for a meeting simultaneously because they had varying

availability times. Due to the nature of the information presented, which included their personal experiences of their graduation day while wearing the conventional academic gown, some participants did not feel comfortable being interviewed in front of others. More iterations of the inclusive academic gown were required after fitting one wheelchair user whose location was like that of the researcher.

It was a wise choice to involve the Technology station in order to facilitate pattern development, computerised technical drawing, and sample sewing. Due to time savings from this procedure, the researcher was able to focus on other research-related tasks. Instead of using precise measurements, the technology station made use of their pre-existing garment blocks based on the participant-provided sizes. As a result, the inclusive academic gown created was not made specifically for the participants but rather for a wider range of consumers who had the same or similar mobility impairments.

The following table outlines the alternative choices and why they were not chosen for this research as explained above.

Table 5.3: Alternative choices available but not chosen for this study

Alternative	Why was it not done?	Potential benefits
Focus group	<ul style="list-style-type: none"> • Available times of participants not aligning • Restricting environment to share personal experiences 	Participants might have been encouraged to share their experiences when hearing the experiences of fellow mobility impaired graduates
Face-to-face interviews	<ul style="list-style-type: none"> • Geographical restrictions: some participants were based in other provinces of South Africa • Financial constraints: the researcher would have had to travel to other provinces for interviews • Lock down pandemic restrictions: the data collection was done during the time of Covid 19 pandemic and there were travel restrictions in place 	To physically interact with the participants and physical experience their energy
Fitting more than one participant: 1 st iteration	Geographically the participant who fitted the 1 st iteration was the only person available	Maybe additional feedback on the garment fit may have been provided
Researcher facilitating the iteration process	Time constraints: the researcher would not have had enough time to facilitate the iteration process as well as the other research duties	

Work with the participant's individual measurements	This would have limited the inclusive academic gown to be suitable for the participant only	The participant would have their own personal inclusive academic gown
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A study of this nature in the area of academic dress, particularly an inclusive academic gown addressing the needs of mobility impaired graduands is not known to have been conducted in South Africa. For this reason, the researcher does not have a study to compare this study with. In essence this may be the first of this kind in South Africa. However, a similar study was done in Dankook. The University of Dankook embarked on a study of designing their academic wear focusing on two aspects namely identity and function (Kang et al., 2012). In the end, the research was completed with a fully newly designed academic dress product that shows the institutions' identity and function. In the case of this study, the suitability of the design features of the current academic dress and whether inclusivity of differently abled persons was considered in the design of the current academic dress were examined, as well as the lack of inclusivity in the assortment used by most institutions of higher learning in South Africa. This practice-based research firstly focused on exploring and then including the experience of multiple cases of differently abled people when designing the new academic dress. Secondly, it investigated, the extent of the use of UDPs in guiding the analysis process. The design and development of academic gown was assisted by UCD. This was done to ensure the inclusivity of all users and explore ways in which design, functionality, accessibility, comfort, and wearability can be improved in academic dress for differently abled persons. The findings from the research informed the product design process.

5.3.3 Contributions of this study and Lessons Learnt

Primary research question

PRQ: How can Universal Design Principles be adopted for the design of inclusive academic dress for differently abled persons?

According to this study, inclusive academic attire gown for mobility impaired persons can be designed using UDPs. The seven UDPs and Guidelines were used to organise and work through the user data in a phase process to achieve this. Each principle and guideline provided detailed instructions for the design of the inclusive academic gown, as seen in tables 4.2.1 and 4.3.1 in Chapter 4. The UDPs, which ensure that the needs of the users are considered in the finished product, cover most design thinking methodologies. This makes inclusiveness for all users possible. to evaluate current designs, direct the design process, and inform consumers and other designers about the benefits of implementing Universal Design into their product development. Depending on what consumers demand, designers can use all or part of the UDP

(Falvo et al., 2007). All people will be able to be included in designs owing to the dedication of all designers.

Research sub-questions

RSQ 1: How do differently abled persons experience the wearing of conventional academic dress?

The information gathered showed that graduands with disabilities experienced a range of emotions when donning the traditional academic gown, including happiness, pride, and a sense of accomplishment as well as physical difficulties brought on by the traditional academic gown's design. This is demonstrated in the chapter's table 4.2.1, problems and needs assessment. Wang et al. (2014) state that as a result, it is both worthwhile and practical to design clothing for disabled persons that meets both their physical and psychological demands. To satisfy end users' needs, clothing designs should be user centred.

Along with ideals like self-worth, respectability, and reputation, it ought to inspire a feeling of security and comfort (Wang et al., 2014:550-551). Whether a person is differently abled or not, the ideals raised above are pertinent and connect to the graduands' emotional needs. In addition to discussing the emotional demands that can be satisfied by a well-thought-out design, these authors also explore the physical needs that must be met by a garment. This is significant to note because it's both interesting and thought provoking. These authors cover both the emotional demands that can be satisfied by thoughtful design as well as the physical needs that must be met by a garment. Humans want satisfaction in their emotional, bodily, and other needs; thus, it is both intriguing and significant to take note of this.

RSQ 2: To what extent can the application of UDPs to the design of academic dress contribute to an improved graduation experience?

The initial design was influenced by the UDP, as shown in the challenge and needs assessment table (Table 4.1) and the table showing the solutions through Universal Design (Table 4.2). Each of the design iterations were analysed according to UDPs (shown in tables 4.3, 4.4 and 4.5) The user's comments about the inclusive academic gown during the picture shoot for the third iteration are included in section 4.7. UD was defined by the (Center for Universal Design 1997 in North Carolina) as the "design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialised design" (Connell et al., 1997:281). The above statement implies that a consistent approach should be used when creating products, wherein all users are treated equally and considered during the design stage

and afterwards in the final product. This is the reason why UD was the chosen as the suitable theoretical framework for this study.

5.3.4 Points to take away

Persons with disabilities prefer being called disabled, rather than differently abled. All participants called themselves “disabled persons”, none of them called themselves differently abled. The view according to Participant 1 and Participant 3 is that “it is the environment that disables a person”. Participant 1 further explained that “That gown is made for a specific, very thin layer of society. Which is people who are not sitting in wheelchairs, people who don’t have mobility impairments. It was not designed for me. It was designed for them. So, by me wearing it, it disables me. Look, so, by saying differently abled, people want us not to focus on the crime, which is the design. They want us to focus on things that are not related to the design”. The view of Participant 1 is that the term differently abled shifts the focus from the things that disables a person and therefore the design process does not deal with the needs of disabled persons. This mindset in-fact allows designers to exclude the disabled community in their design and end up mainly designing for people without disabilities.

UDPs ought to be taken into consideration by all designers when designing their products.

A conducive environment is important for interviews. When collecting data involving personal experiences of participants who are differently abled, it is recommended that the participants’ freedom of speech be properly considered. The researcher must develop an interview setting that is conducive to free communication. It is therefore advised that for such studies, individual, semi-formal interviews be conducted, with no other participants present. The interviewee ought to be allowed the time, space, and freedom to express themselves. This is especially significant when personal experiences are expected to be revealed during the interviews.

All disabilities are unique, therefore no one design will accommodate all the body needs. Differently abled graduands ought to have the option of having a custom-made academic dress based on their distinctive and unique body form and needs, institutions of higher learning have a duty to meet this requirement.

5.4 Recommendations

5.4.1 Policy making and practice

For the sake of inclusion of all stakeholders of the institutions of higher learning in the area of academic dress, particularly the academic gown there should be policies drafted that will support the following: i) The facilitation of custom-made academic gowns for differently abled persons with unique body shapes. ii) Inclusion of the full length inclusive academic gown in the

assortment of academic dress in institutions of higher learning in South Africa. 3. Inclusion of the shorter back inclusive academic gown in the assortment of the academic dress in institutions of higher learning. This action will go a long way in ensuring inclusion of differently abled person in the area of academic dress.

5.4.2 Further studies

More research on inclusive academic gown is recommended, which may include the online exhibition of the photo shoot of the inclusive academic gown worn by a differently abled person done for this research. This exhibition will display the final product of the inclusive academic gown. Also, assess the perception of the higher education institutions' management concerning the inclusive academic gown constructed. Furthermore, a real-world pilot testing of the inclusive academic gown during graduation season will be important. This will contribute data to the study that could be game-changing for future graduations in institutions of higher learning. It will enhance academic dress inclusion for differently abled persons in institutions of higher learning. The process of facilitating custom-made academic apparel for differently abled graduands with body requirements may be initiated and launched alongside pilot-testing.

If institutions of higher learning endorse the inclusion of an inclusive academic gown for differently abled persons in their academic gown collection, this study will have met its purpose. This will mean that during graduation season, differently abled people will have a choice of the inclusive academic gown, that will provide them with a pleasant shopping experience. Wearing the inclusive academic gown may result in less physical effort when donning, doffing and wearing the garment throughout the graduation day. It will bring pride and joy to differently abled persons and may encourage more differently abled persons to attend their graduation day rather than to deliberately stay away because of exclusion in the form of conventional academic dress.

5.5 Conclusion

The data gathered from interviews with differently abled people, who articulated their experiences concerning the conventional academic dress, informed the design of the inclusive academic gown. It can be concluded that, there is a need for an inclusive academic gown for differently abled persons sitting in wheelchairs. This inclusive garment will allow for more ease of movement and less fabric bulk on the garment. Additionally, both options, the short back design and the full back design, can be made available to differently abled graduands. The conventional academic gown hinders differently abled persons from fully enjoying their graduation ceremony, and the fit is often problematic.

Universal Design and its Principles were used to identify and address the needs of differently abled persons in an academic gown. The final product will be usable by both differently abled persons as well as people without disabilities should they prefer so.

To ensure inclusion of all students in the area of academic dress, institutions of higher learning ought to consider including the inclusive academic gowns in their selection of academic dress. Having a dedicated office that will facilitate the process of custom-made academic gowns for differently abled graduands with unique body needs, according to their needs. On the other hand, mobility impaired persons, who use crutches as walking aid, can similarly be assisted where academic gown is concerned. An adjustment on the conventional academic gowns may be made, where there may be the option of attaching a trim that will fasten and keep the neckline in place. This will prevent the garment from falling off their shoulders when there is physical movement.

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Appendix A: Ethics Certificate



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03 May 2022

Sindiswa Delia Papa
c/o Department of Design
CPUT

Reference no: 195086791/2021/19

Project title: Universal Design in Academic Dress: A practice-based study of differently-abled persons in Cape Town, South Africa.

Approval period: 09 June 2021 – 31 December 2023

This is to certify that the Faculty of Informatics and Design Research Ethics Committee of the Cape Peninsula University of Technology approved the methodology and ethics of Sindiswa Delia Papa (195086791) for the MTech Applied Design.

Any amendments, extension or other modifications to the protocol must be submitted to the Research Ethics Committee for approval.

The Committee must be informed of any serious adverse event and/or termination of the study.



Dr Blessing Makwambeni
Acting Chair: Research Ethics Committee
Faculty of Informatics and Design
Cape Peninsula University of Technology

Appendix B: Consent form



Cape Peninsula
University of Technology

FID/REC/ICv0.1

FACULTY OF INFORMATICS AND DESIGN

Individual Consent for Research Participation

Title of the study: Universal Design in Academic Dress: A practice-based study of differently-abled persons in Cape Town, South Africa.

Name of researcher: Sindiswa Delia Papa
Contact details: email: papas@cput.ac.za phone: 079 189 6638

Name of supervisor: Prof. Izak Van Zyl
Contact details: email: vanzyli@cput.ac.za phone: +27214691115

Purpose of the Study: The purpose of this study is to design suitable academic dress for differently-abled persons and contribute to best practices for inclusivity in institutions of higher learning. Ideally, all human beings, regardless of their physical ability or impairment, should enjoy clothing items that have no issues of discomfort or misfit. Differently-abled people do experience problems with clothing items that are uncomfortable, where little or no attention is given to clothing items that provide comfort to the wearer. The lack of inclusivity in the assortment of academic dress in SA institutions of higher learning needs to be examined and alternatives proposed.

Participation: My participation will consist essentially of being an interviewee.

Confidentiality: I have received assurance from the researcher that the information I will share will remain strictly confidential unless noted below. I understand that the contents will be used only for M Tech thesis and that my confidentiality will be protected by ensuring that the identity of the participants will be protected by coding them as P1, P2, P3, etc.

Anonymity will be protected in the following manner, by ensuring that the identity of the participants will be protected by coding them as P1, P2, P3, etc, then store this coded list with corresponding names on a password-protected computer that only the researcher has access to. On the thesis there will be no mention of the participant's real names. In addition, where fitting photos are used the blanking out of faces will be applied.

Conservation of data: The data collected will be kept in a secure manner for a period of five years, digitally recorded interviews will be encrypted and kept in a password-controlled environment.

Voluntary Participation: I am under no obligation to participate and if I choose to participate, I can withdraw from the study at any time and/or refuse to answer any questions, without suffering any negative consequences. If I choose to withdraw, all data gathered until the time of withdrawal will be destroyed.

Additional consent: I make the following stipulations (please tick as appropriate):

	In thesis	In research publications	Both	Neither
My image may be used:				
My name may be used:				
My exact words may be used:				
Any other (stipulate):				

Acceptance: I, _____

agree to participate in the above research study conducted by Sindiswa Delia Papa of the Faculty of Informatics and Design, Fashion Department at the Cape Peninsula University of Technology, which research is under the supervision of Prof. Izak Van Zyl.

If I have any questions about the study, I may contact the researcher or the supervisor. If I have any questions regarding the ethical conduct of this study, I may contact the secretary of the Faculty Research Ethics Committee at 021 469 1012, or email naidoo@cput.ac.za.

Participant's signature: _____ Date: _____

Researcher's signature: _____ Date: _____

Appendix C: Focus group guide



UNIVERSAL DESIGN IN ACADEMIC DRESS: A PRACTICE-BASED STUDY OF DIFFERENTLY-ABLED PERSONS IN CAPE TOWN, SOUTH AFRICA

Supervisor:

Prof Izak van Zyl

Co-supervisors:

Ms Ryna Cilliers

Ms Michelle Van Wyk

Cape Town | 30th July 2021

1. Welcome and introduction.
2. Start the discussion using the questions below, the nature of the interview is semi-formal which allows the participant to be free in elaborating on their answers to the questions.
3. Conclusion of the discussion and closure.

Interview questions

- What was your experience with the academic dress, the gown in particular?
- Would you be open to the idea of a specific academic dress for differently-abled persons?
- What specific features would you like to see in academic dress?

Appendix D: Data Management Plan

UNIVERSAL DESIGN IN ACADEMIC DRESS: A PRACTICE-BASED STUDY OF DIFFERENTLY-ABLED PERSONS IN CAPE TOWN, SOUTH AFRICA

A Data Management Plan created using Data Management Planning tool (DMP tool)

Creator: Sindiswa Papa

Affiliation: Cape Peninsula University of Technology

Template: Cape Peninsula University of Technology

Project abstract:

This research study will explore Universal Design in clothing for differently-abled persons with impaired mobility in Cape Town, South Africa. Through personal interviews with participants, problem areas that will be addressed on the current academic gown offering by institutions of higher learning in South Africa will be established. Interviews will be conducted with the participants and data will be electronically recorded as well as in writing. Thereafter, the collected data will be analysed. Through this process, a suitable universal design solution can be applied to correct the challenges thus improving the design, functionality, accessibility, and wearability of the garments. A product design process will begin and designs with the solution to the problems will be drawn, samples made, and presented to participants. Thereafter feedback will be sought from the participants regarding the experience of wearing the new inclusive designs. This research aims to design a suitable academic gown for differently-abled persons and to contribute new knowledge to the South African institutions of higher learning regarding a user-friendly academic gown for differently-abled community, in their graduation attire range. Inclusivity of differently-abled persons in the area of academic dress is the core existence of this study.

Last modified: 01-12-2022

UNIVERSAL DESIGN IN ACADEMIC DRESS: A PRACTICE-BASED STUDY OF DIFFERENTLY-ABLED PERSONS IN CAPE TOWN, SOUTH AFRICA - Data Management Plan

DATA COLLECTION

What data will you collect/create?

Data will be collected in the form of individual interviews using Microsoft Teams and Zoom. These will be video recorded by the researcher. There will be a total of five individual interviews for the purpose of getting to know the experiences of the participants regarding the wearing of the current academic gown offered by the South African institutions of higher learning, during graduation season. There is currently no study known to have been covered in this area of academic dress in South Africa, for the researcher to reuse existing data. The purpose of the study is the inclusion of differently-abled persons in the area of academic dress.

How will the data be collected or created?

Data will be collected in the form of individual interviews using Microsoft Teams and Zoom. These will be video recorded and the researcher will also be taking written notes during the interviews.

DATA DOCUMENTATION AND METADATA

What documentation and metadata will accompany your dataset?

One data repositories namely; esango (<https://esango.cput.ac.za>) will accompany this study's data set.

ETHICS AND LEGAL COMPLIANCE

How will you manage any ethical issues pertaining to data?

All participants will be given coded names such as Participant 1, 2, 3, 4, and 5. All participants will submit a formal written and signed consent before the interview. This will be done to allow data to be shared and reused.

Follow proper ethical procedures as required by the Research Committee of the University. This includes following data policies in terms of data sharing and preservation. The project leader or researcher can create a link (private link, reserved DOI) that will secure each dataset and this will allow sharing at the same time protecting the datasets between project team members. The data for the project will be managed and stored in one of the data repositories named esango (<https://esango.cput.ac.za>).

How will you manage copyright and Intellectual Property Rights (IPR) issues?

Findings will remain the property of the researcher and the University (Cap Peninsula University of Technology). Our findings will be published in peer-reviewed Open Access Journals. Therefore there will be no unforeseen copyright and IPR issues.

DATA STORAGE AND BACKUP

How will you store and back up your data during the research?

CPUT support researchers with two data repositories including the institutional repositories. The data for this project will be saved and backed up in CPUT data repository names esango (<https://esango.cput.ac.za>).

How will you manage access and security?

During the research process access to datasets will only be given to direct or indirect participants by assigning rights. This includes collaborators who will be given rights to read, edit and collaborate through the data repository (<https://esango.cput.ac.za>). These research data repository is safe and secured and will allow the team leader to implement rights management in each PROJECT folder for active datasets based on specific groups or individuals.

Using esango, a private link or reserved Digital Object Identifier (DOI), the project leader or researcher will create a link that will secure each dataset and this will allow sharing at the same time protecting the datasets between project team members.

DATA SELECTION AND PRESERVATION

Explain which data should be retained, shared, and /or preserved?

All collected data including interview videos, other additional pictures and videos, written transcripts as well as signed consent forms, are to be kept for a period of five years for the purpose of further studies that will be recommended.

DATA SHARING

How will data be shared?

Data will be shared between collaborators using "MY DATA and PROJECT" on esango (<https://esango.cput.ac.za>). This will allow the project leader/s or researchers to INVITE participants via email to view or participate in each project folder and each dataset will be protected by either a private link or DOI. After publications, data will be shared using Open Access Repositories esango (<https://esango.cput.ac.za>) and the Institutional Repository (<http://digitalknowledge.cput.ac.za/>) for public access.

Are any restrictions on data sharing required?

All data will be available for use by other researchers on request from the researcher for the purposes of further related studies only. As confidential information was shared by the participants of this study. This is for the period of the first five years.

The researcher may restrict the sharing of data within CPUT repository esango (<https://esango.cput.ac.za>) by giving rights (view only, read, collaborate, edit) to each participant using the data repository.

RESPONSIBILITIES AND RESOURCES

Who will be responsible for data management?

Sindiswa Papa the researcher of this study will be responsible for data capture, metadata production, data quality, storage and backup, data archiving & data sharing. She will be responsible for ensuring relevant policies are being respected.

What resources will you require to deliver your plan?

The researcher will seek assistance from the library eResearch support, on how to use the CPUT repository for data management.

Appendix E: Editing Certificate

5 December 2022

SINDISWA PAPA

Faculty of Informatics and Design
Cape Peninsula University of Technology
Cape Town

RE: CERTIFICATE - EDITING OF MASTER'S THESIS

I, the undersigned, herewith confirm that the editing of the Master's thesis of Sindiswa Papa, "*UNIVERSAL DESIGN IN ACADEMIC DRESS: A PRACTICE-BASED STUDY OF DIFFERENTLY-ABLED PERSONS IN CAPE TOWN, SOUTH AFRICA*" has been conducted and concluded.

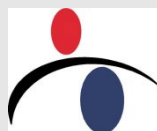
The finalised thesis was submitted to Ms Ryna Cilliers on 5 December 2022.

Sincerely



Professor Annelie Jordaan
DTech: Information Technology
Ph: 065 990 3713

Member: SATI 1003347



South African Translators' Institute (SATI)