



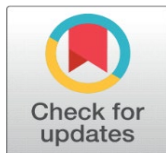
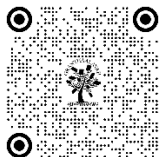
DESIGNING ADAPTIVE CLOTHING FOR DIFFERENTLY ABLED CHILDREN USING WHEELCHAIR

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ABSTRACT

Adaptive clothing is made for patients who struggle to wear and remove off clothing because of disabilities or restricted mobility. This adaptation still accommodates their difficulties while allowing persons with disabilities to dress like their counterparts. It was discovered that the wearer's freedom and independence were increased by this type of adaptable clothes. As the wearer's sense of autonomy and control over their body develops, they are better able to participate fully in their community. This kind of adaptable clothing design increases psychological comfort in addition to physiological comfort by improving the wearer's self-confidence. This study's main objective was to acquire qualitative data regarding the clothing needs of kids with impairments. An open-ended interview schedule with boys of 10-15years of age group and their care takers was used. Data was gathered addressing the physical effects of the handicapping condition that relate to clothes and dressing, the ways of procuring clothing, dressing considerations, clothing needs, and clothing issues that may arise when a support device is employed. A restricted physical movement was observed in every case, and the wheelchair was the most common support equipment. After analyzing the problem area for putting and taking off clothes, the adaptive garments were designed. The designed garments were ranked by the experts from designing field. The collection was found to be highly appropriate. The top ranked design was constructed for final wear trial. It has been discovered that wearing this type of adaptable apparel increases the wearer's freedom and independence. Adaptive clothing increases the wearer's sense of autonomy and control over their body means that they can more meaningfully participate in their community.

Keywords: Adaptive Clothing, Differently Abled, Locomotor Disability, Water-Resistant



1. INTRODUCTION

Clothing is a huge part of how someone portrays oneself to the world and how they feel about themselves. In addition, clothes shield us from many environmental influences. Clothing is essential since it gives people physical and psychological comfort. A person's daily activities can be profoundly impacted by a disability, which can be caused by cognitive, intellectual, mental, physical, or sensory harm, or by a combination of these. Any congenital ailment, impairment, handicap, or illness that

significantly limits mobility for 12 months or more (i.e., is present from or soon after birth) is referred to as a mobility impairment. Our preferences and etiquettes are influenced by a variety of variables. People with physical difficulties and healthy individuals can be distinguished by the obvious differences. For the disabled individual, it is necessary to have both aesthetically pleasing and practical features. Aesthetic components are necessary for psychological satisfaction, whereas increased independence in getting dressed and taking off clothes requires adaptable or useful designs [Jemtå et al. \(2009\)](#).

Clothes designed for those with physical limitations, the elderly and people with limited mobility who may have trouble in dressing themselves is known as adaptive clothing. These people are unable to operate fasteners like velcro tape, magnetic closures or cover zippers. It might also happen due to insufficient means of dressing themselves [Poonia \(2020\)](#), [Kabel et al. \(2016\)](#). Additionally, how a person feels in social settings and around other individuals is significantly influenced by their wardrobe choices.

It was researched in a study that to feel comfortable moving, sitting, and performing any task, a disabled person should wear flexible clothing [Antonela et al. \(2014\)](#). The aesthetic value and practicality of clothing can be improved, which will enhance the standard of living for those who are disabled. Around 240 million children worldwide are said to be impacted by some form of disability [UNICEF \(2022\)](#). However, the special demands of differently abled people will differ from those of the general population. WHO report, 2022 estimates that, out of 1.3 billion people, 16% of the world's population currently suffers from a disability.

The importance of physically challenged children in society cannot be overstated. People in this community frequently find it difficult to participate in daily activities due to physical differences, such as mobility difficulty [Hall & Lobo \(2018\)](#). Mobility issues can result from a wide range of physical limitations, ailments, injuries, and disorders. However, they can be broadly divided into two groups: acquired (i.e., developing later in life) and congenital (i.e., present at birth). Individual adaptability is largely influenced by whether an impairment is present at birth or develops later in life. For example, Congenital disability patients report better life satisfaction levels, self-identity, and self-efficacy (related to their handicap) than those who make accommodations for acquired disabilities. [Sharma \(2020\)](#) concluded that in the fashion sector, adaptive clothing represents a new step towards functional apparel. As a result of the initiatives brands, designers, producers, and other organizations have taken to advance this social cause, the world has become more inclusive in terms of design.

[Ayachit & Thakur \(2017\)](#) mentioned in their research that, given the large number of impaired people residing in the country today, the issue of disability needs to be properly addressed and treated. The socioeconomic class to which the maximum of these people belong should receive special consideration in relation to the cost, durability, practicality, and simplicity of maintenance of such apparel. [Pargai et al. \(2015\)](#) stated that while making designs for the kid, both functional and aesthetic qualities were taken into consideration. Clothing that is attractive to the eye encourages children to engage in positive psychological behavior.

[Rutledge \(2017\)](#) while doing the research discovered two techniques for including design for disabled children in the classroom, one through integrating empathy in product design other than applied designs to solve issues. [Shen et al. \(2022\)](#) stated in his studies that while developing adaptive clothing, a number of factors must be taken into account. Clothing for a differently abled person should be hygienic and water-resistant. When designing and sewing, special characteristics


like simple closures for handling and wearing diverse outfits with ease should be included. When each of these special characteristics are added in garments, it boosts the individual's confidence.

Tuteja & Nigam (2017) found that only small minority of people with various disabilities are content with the clothing that are available, while the majority are not. There are many reasons why people are not satisfied with the current clothing. It could be challenging for them while donning and doffing the clothes, struggle to operate the fasteners, or are unhappy with the design of the clothes because it does not meet their needs. They may also be unhappy with the incorrect placket opening. According to a study by Tukhbatullina et al. (2019) garment should be developed with detachable wrist cuffs to prevent wearing them out quickly; - using knitted and elastic materials and inserts from them; - wearing a high corset belt to support the posture and maintain the back straight.

2. METHODOLOGY

An Amritsar-based NGO called Agosh was chosen for the study, they had 87 number of students among which 12 boys between the ages of 10-15 years were randomly selected. This NGO has opened a school for differently abled children where they learn daily activities. Children were personally interviewed through structured questions. The boys were affected by locomotor disability which is a barrier for an individual in doing daily activities. More data was gathered regarding issues with clothes and the specifics of the construction that needed to be included in the special adaptive garments. A comprehensive survey was designed to address clothing issues and details regarding the children's current wardrobe were requested from the mother of the children. Ten designs were drafted based on the information provided. Mothers and design professionals ranked the concepts using 5-point Likert scale according to the garment's more appropriate usefulness and aesthetic appeal. The clothing's fabric composition varied depending on the wearer's and their carers' preferences. Digital pattern of the top-ranked design was created using JDPDS software based on the results of a Google Form, and they were built for the final wear trial experiment.

Table 1

Table 1 Designs for Differently Abled Children			
Designs	Features	Fasteners	Function
 <p>D1</p>	<ul style="list-style-type: none"> Sweatshirt with Raglan sleeves, kangaroo pocket and cuffs at sleeve. Capri is designed with Front center opening and back elastic for easy put on and put off. 	<ul style="list-style-type: none"> Metal zipper Magnetic snappers 	<ul style="list-style-type: none"> Side opening in the upper part will help in easy putting and pulling. As zippers are placed at mid of thighs in vertical position it would be easier for the care taker.

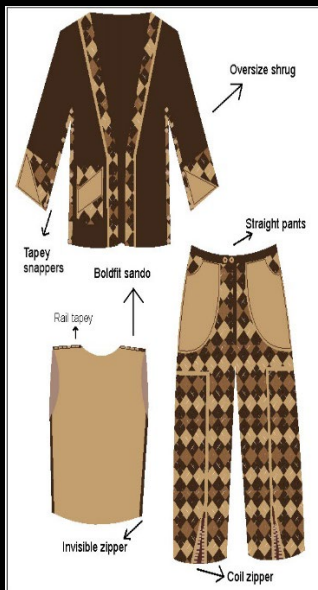


D2

- Cotton Shirt with front Opening and patch work shirt.
- In straight pants cargo pocket and side opening was given to add functional and aesthetic feature

- Velcro
- Elastic
- Magnetic closures
- Tapey snapper

- sleeves are loose and will prevent perspiration and provide air permeability.
- Printed trousers are adding fashionable look. velcro at sides will allow easy movement.

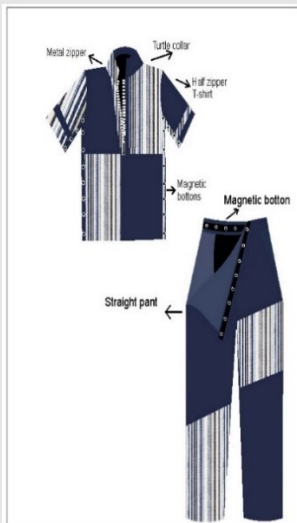


D3

- Oversize shrug with front opening
- Sando to wear under shrug
- Straight wide pants with cargo pockets.

- Tapey snappers
- Rail tapey
- Coil zipper

- Full front opening and side opening and opening in sleeves will allow the person to wear easily.
- Pants with front coil zipper can help the care to wear and remove.

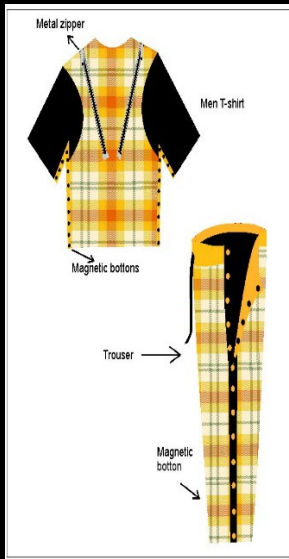


D4

- Turtle collared Shirt with color blocking and striped and plain fabric was used.
- Straight pants with one side opening with color and fabric blocking is done.

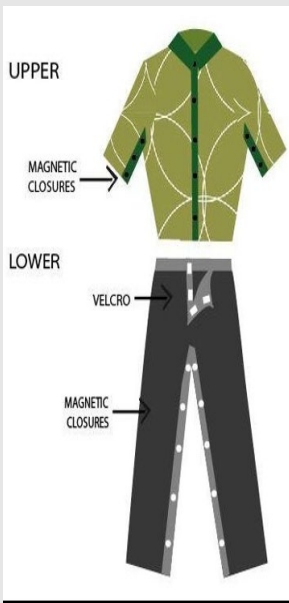
- Magnetic buttons
- Metal zipper

- Magnetic buttons on waist and side seam and sleeves are given to provide comfort to the wearer and caretaker.
- Straight pants with magnetic buttons on the waist and side seam to provide comfort.



D5

- The shoulders of t shirt were Overlapped and had opening.
- Padded overlapping back seat of trousers.
- Large buttons
- Velcro
- Shirt with overlapping shoulder allows for easy putting and pulling off garments.
- Overlapping quilted back will allow free and in comfortable sitting.



D6

- Shirt had collar with front and inner arm opening
- Capri had front opening and inner leg opening.
- Velcro
- magnetic closures
- Front opening shirt with sleeve opening will allow in free movement.
- Capri with inner leg opening will allow the person for easy passing of urine.



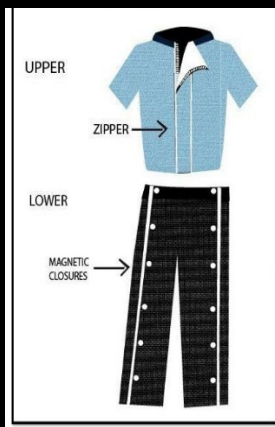
D7

- Half sleeved knitted t shirt with half opening
- Lower in stretchable fabric.
- Elastic
- Snap buttons
- This fabric will allow the wearer for easy movement.



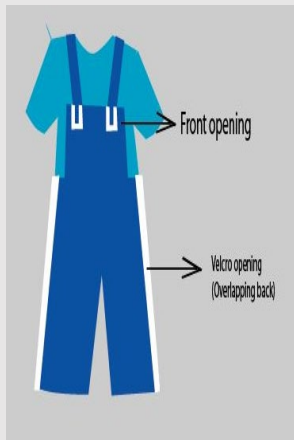
D8

- Half sleeved shirt with front and armhole opening.
- Lower with half front and half side opening
- Snap buttons
- Magnetic closures
- Easy opening of shirt.it can be made with or without sleeves.



D9

- Half sleeved shirt with front opening.
- Trousers with center front opening.
- Zipper
- Magnetic closure
- Front opening allows to open or shirt with less efforts.



D10

- Upper t-shirt in hosiery
- Dungaree's as lower garment with front opening on the upper part and lower back overlapping front opening.
- Velcro
- Back waist elastic
- Front opening allows to put on and pull off. Side opening in the lower part allows in comfortable wearing.

3. RESULTS

It was observed that the differently abled children face problems while donning and doffing of clothes, they are not able to handle clothes themselves. They always need help and it becomes very difficult to move their body parts to wear clothes. These children can't wear clothes like normal people, they need special elements in their clothing so that they would not face much problems while wearing them. So, it

was looked as main problem and designs for adaptive clothing were designed. Zippers, Magnetic closures, Velcro, elastic were added to their clothing designs so that opening and wearing becomes easier. Then the designs got evaluated from respondents.

3.1. PERSONAL INTERVIEW INFORMATION

Through personal interview method it was found that boys belonging to age group of 10-15 years have been suffering from locomotor disability due to genetic disorder. The boys were not able to hold something or put on or off their clothes themselves as there was lack of movement of arms and legs. Additionally, it was discovered that the kids' clothing needs were entirely met by their mother or any other relative. The children's attire consisted mostly of premade round-necked t-shirts, summer shorts, winter sweaters and pants. Mothers had difficulties in putting on and taking off clothing. the children have been suffering from pain in raising the hands and lifting legs during wearing and removing off the garments. The children and their care takers were not aware of adaptive clothing.

3.2. DESIGNING OF CLOTHING

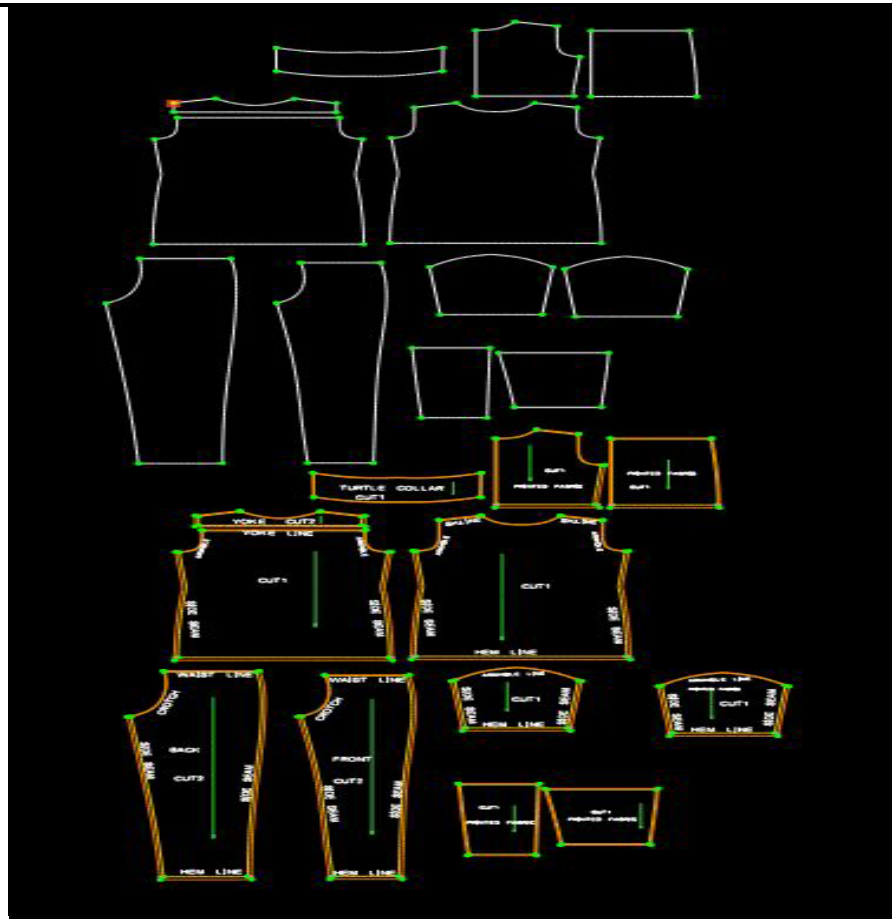
The designs were made for summer wear, according to the preference of the children and care takers through interview method therefore shirt, trousers, capri and t shirts were designed. Both aesthetically pleasing and useful qualities were taken into account during design. The applicable details of Designs 1 through 10 are displayed in the drawing form.

3.3. RANKING OF DESIGNS

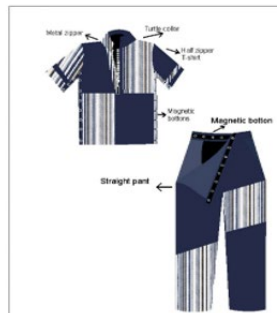
The raking was done from design experts and care taker through google form. 65 respondents were taken for this study. Respondents were highly qualified as they belong to the field of design faculty and possessed both design and construction knowledge. Ranking was done by considering these factors i.e., fabric, color, comfort designing features etc. which were added to the garments. It was done on 5-point rating scale by following the parameters of excellent, very good, good, average and poor. The design which was found highly suitable was ranked excellent and so on and the design which was not found suitable was ranked the lowest i.e., poor.

3.4. CONSTRUCTION FOR FINAL WEAR TRIAL

Digital patterns were made by using JDPDS software before the construction of the design. The top ranked design was constructed. Cotton fabric was used for the shirt and capri. We bought the foam, zipper and Velcro from the Amritsar, Punjab, local market. Ultimately, the child received the item for a wear trial, during which they had a single day to wear it. Following the wear trial, the investigator conducted a face-to-face interview with the child's mother using the self-structured schedule to get feedback on the acceptability, comfort, and aesthetics of the newly created adapted clothing.



Pattern for top Ranked Design



4. RANKING OF DESIGN

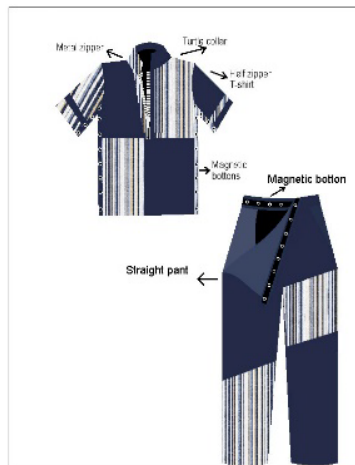
Table 2

Table 2 Designs for Differently Abled Children										
Designs Respondents	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
R1	1	3	2	1	1	3	3	3	2	3
R2	2	2	2	1	1	1	3	2	3	3
R3	1	2	2	1	3	1	3	3	1	2
R4	1	2	3	1	1	3	1	3	1	4
R5	2	3	2	1	3	1	3	2	1	3
R6	1	1	3	2	3	1	3	1	2	2
R7	3	3	3	1	1	1	1	3	3	4
R8	2	2	2	2	1	3	3	2	2	2
R9	2	2	1	1	1	1	1	2	2	3
R10	3	3	3	1	4	3	2	2	5	3
R11	3	1	2	1	4	1	3	3	2	3
R12	1	3	2	1	3	1	4	3	1	2
R13	2	1	1	1	2	2	3	3	2	2
R14	3	2	2	1	2	2	4	2	4	4
R15	1	2	4	2	2	1	1	4	3	2
R16	1	3	3	1	4	1	3	4	3	2
R17	2	2	2	1	3	2	3	2	1	4
R18	2	3	3	1	2	1	1	2	3	3
R19	2	3	2	1	2	1	5	2	4	2
R20	1	2	4	1	2	2	3	1	2	4
R21	1	5	2	1	3	2	3	1	1	1
R22	2	2	2	1	3	2	4	1	1	1
R23	1	2	3	1	2	2	3	2	2	1
R24	3	4	3	1	3	4	4	2	3	3
R25	1	2	3	1	2	3	4	3	3	3
R26	2	3	3	1	2	2	4	2	2	1
R27	1	2	3	1	2	3	2	2	1	1
R28	2	3	3	1	2	4	2	2	2	1
R29	3	4	4	1	2	3	2	2	2	1
R30	3	2	3	1	2	3	4	2	2	1
R31	3	1	2	1	1	3	2	2	2	3
R32	4	2	1	1	1	3	2	2	3	3
R33	3	1	2	1	3	3	1	2	3	3
R34	2	2	1	1	3	3	2	2	2	2
R35	2	3	2	1	3	2	2	1	1	1
R36	4	3	3	1	2	2	1	2	2	1
R37	3	4	3	3	3	3	2	1	1	1
R38	2	3	3	1	2	2	1	2	2	2
R39	1	2	5	1	3	3	2	3	3	2
R40	2	2	1	4	2	5	3	3	3	1
R41	1	1	3	1	2	3	3	1	1	3
R42	2	2	5	1	3	3	3	3	2	3
R43	1	3	1	1	1	4	2	1	4	2
R44	3	2	2	1	1	1	1	2	5	1

R45	2	3	2	1	3	2	1	2	2	2
R46	3	1	3	1	1	2	2	2	3	2
R47	3	1	1	1	3	2	4	4	2	4
R48	2	2	2	1	3	2	3	3	4	1
R49	3	3	1	1	1	3	3	2	2	2
R50	2	2	3	1	2	4	3	3	1	1
R51	2	3	2	1	2	2	2	3	2	1
R52	2	1	3	1	3	2	2	1	4	1
R53	2	2	2	1	3	4	2	2	1	1
R54	2	3	2	1	2	3	2	1	2	1
R55	3	1	4	1	2	2	2	1	1	2
R56	4	2	2	1	2	2	2	3	1	2
R57	2	3	2	1	2	3	2	1	3	2
R58	3	1	2	1	2	2	5	1	3	2
R59	2	4	3	1	2	2	3	1	2	2
R60	2	2	2	1	1	2	3	2	2	4
R61	2	2	4	1	2	3	3	2	2	2
R62	4	4	2	1	2	3	2	2	2	2
R63	3	3	4	1	2	3	2	3	2	2
R64	2	2	1	2	1	2	2	1	2	4
R65	2	2	1	3	1	4	2	4	2	5
Excellent	15	11	8	59	11	13	10	14	15	19
Very good	29	27	27	3	32	22	22	30	28	22
Good	16	20	22	1	19	25	23	29	28	22
Average	4	5	6	1	4	5	6	3	5	8
Poor	0	0	1	0	0	1	1	0	2	1
Percentage	-	-	-	90.7%	49.2%	-	-	44.6%	3.07%	-
Positions	-	-	-	1st	2nd	-	-	3rd	10th	-

5. DISCUSSION

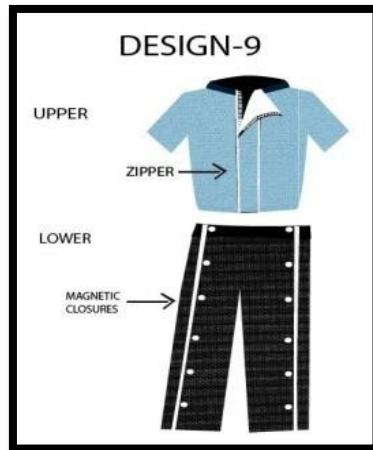
It is found that Design no. 4 ranked 1st position because the fabric used was quite comfortable and designing of this design seems more comfortable to respondents while putting and pulling it, as well as color combination is also very appealing.



It is found that Design no. 5 ranked 2nd position because of its print and designing. The garment's top portion was a looser fit which would allow the skin to breath. The lower part was an adjustable one it could be trouser or can be converted to capri. Respondents find its color combination attractive too.



It is found that Design no. 9 ranked last position because most of those surveyed didn't find its color nor its designing appealing and comfortable.



6. CONCLUSION

The designs had a high degree of appropriateness. Finally, the clothing's style and elegance may benefit youngsters in a number of ways. It is now easier for the mother and the carer to dress and undress. A sense of physical and psychological comfort and stability may be provided as the practical aspects are added to make the clothing appear identical to the regular ones. Wearing aesthetic pleasing as well as comfortable and functional dress the children were able to live healthy lives. It was discovered that the wearer's freedom and independence were increased by this type of adaptable clothes. As the wearer's sense of autonomy and control over their body develops, they are better able to participate fully in their community. This kind of adaptable clothing design increases psychological comfort in addition to physiological comfort by improving the wearer's self-confidence. Future research may be conducted by focusing on a specific differently abled in order to standardize the design for that condition, even if this study is just concerned with children who use wheelchairs. Wearing adaptable clothing will help everyone with a disability.

They'll feel more confident and upbeat about life as a result of this. It is possible to create more adapted apparel for individuals with a variety of abilities. To create adapted clothing, a variety of problems might be researched. After these clothes are designed, adapted clothing will be made, which will help society by generating jobs.

7. LIMITATIONS AND FUTURE STUDIES

Additional studies may be conducted in a similar way for kids by creating and designing adaptive apparel for kids with different physical impairments. In order to provide enough money for this work, a proper proposal might be produced to merge this kind of disability programs with some governmental schemes. Highly ranked design number 4 can be developed and distributed to differently abled children. In addition, a number of non-governmental organizations may act to incorporate these adaptive clothing programs in the initiatives relevant to children with impairments. It is important to organize a variety of awareness campaigns to increase public awareness of programs that include children with impairments.

CONFLICT OF INTERESTS

None.

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