



Innovative Technology-Driven Model for Employment Accessibility in The Deaf Community

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ABSTRACT

Hard-of-hearing individuals are often presumed to be limited to specific job domains. However, in the current technological era, advancements in information technology and the use of computers as tools have the potential to significantly reduce the barriers faced by deaf and hard-of-hearing individuals, enabling them to access a wider range of employment opportunities. It is also essential to develop employment policies that empower the deaf community to expand their employment opportunities through technological training. This research work identified some very crucial factors that hinder in the way of Deaf people in their practical life especially in employment. A technology-based employment model is proposed to provide seamless communication between deaf and normal people and provide support to deaf or hard-of-hearing people, ultimately enabling them to earn a living with dignity and respect.

Keywords: Deaf or Hard-of-Hearing (DHH), Deaf Culture, Employment Model, Social Factors

1. INTRODUCTION

Disability is a global reality, with over 15% of the world's population living with some form of disability. Pakistan, as an under developing country, reports approximately 2.49% of its population as living with disabilities, according to the *National Policy for Persons with Disabilities (2002)* [1]. Among these individuals, about 7.40% are identified as deaf. Individuals with deafness or hard-of-hearing (DHH) are often perceived as unproductive members of society. However, they face numerous challenges, including difficulties in housing, travel, and communication. More critically, they encounter significant barriers to employment or are prevented.



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Table-I Deaf Population Statistics in Pakistan [3]

Province	Total	Rural	Urban
Punjab	149235	109214	40033
Sindh	57437	23236	34181
KPK	28895	24638	4253
Baluchistan	7672	6134	1542
Islamabad	1020	486	534

from accessing job opportunities for various reasons [2].

According to Pakistan's disability law (2020), the estimated number of people living with disabilities in the country varies significantly, ranging from 3.3 million to 27 million [3]. A person who is less hearing power [4] or cannot be able to hear should be educated and motivated to become a useful entity of society. In fact, it is not possible in this era of technology where we have Smart devices along with several applications that can be helpful to achieve the task. All over the world researchers have been identifying the fact for years that deaf community is the part of society, and we should provide them useful education with flexible environment so that they can not only earn for themselves but also can-do work for their country.

Table-II**Disability wise Distribution of Organization [2]**

Disability wise Distribution of	AJK	Baluchista	Capital	Northern	NWFP	Punjab	Sindh	Total
Hearing impairment	6	5	15	11	22	160	48	267
Mental retardation	3	4	14	8	17	140	67	253
Visual impairment	1	4	15	12	15	103	25	175
Physical disability	4	5	19	10	28	129	53	248
Multiple disabilities	0	1	14	1	11	66	27	120
Total	14	19	77	42	93	598	220	1063

A. ANALYSIS OF PROBLEMS FACED BY DEAF OR HARD-OF-HEARING PEOPLE

Hard-of-hearing individuals are often presumed to be limited to specific job domains. However, in the current technological era, advancements in information technology and the use of computers as tools have the potential to significantly reduce the barriers faced by deaf and hard-of-hearing individuals, enabling them to access a wider range of employment opportunities. Deaf or hard-of-hearing people can prove them as be productive people of society. Therefore, this the need to identify the problems which send them back not only from employment but also from back them from each and every event of their life. The common factors which create hindrance in their life may be personal, social, Environmental, cultural, organizational etc. To manage these issues one can make them good citizen and professionals.

1. Personal Issues

Mainly it is understood that people deal with deaf or hard-of-hearing individuals either in an irritating manner or sometime show disappointment for them. In both cases a deaf and hard-of-hearing person feels offence and naturally demotivated. Since their childhood they bear this kind of behavior that can ruin their other inborn talent or skills. If from childhood, they are treated as the normal individuals in every walk of life, surly they will become a beneficial part of the society. They should be educated, trained, and guided about the future so that they don't suppose themselves to be a burden on society.

2. Social Issues

In less developed countries it has been observed that becoming a social norm special needs people are the responsibility of the family to which they belong. Therefore, these people are sometime isolated from social activities as they are depending on their caring persons in the result, they could not be able to actively participate in social happenings as a normal people. Secondly due to this social attitude towards deaf or hard-of-hearing child their family tries to keep their child away from social activities this is another way by which deaf or hard-of-hearing people are isolated

from social activities and loss their confidence level.

3. Environmental Issues

Employment for the deaf is a global issue, which is being handled with the help of ICT skills training to reduce the challenge [5]. Environmental factors are very important as the surroundings where deaf or hard-of-hearing people grow provide support to build their confidence level, because of this confident they can be able to move with normal people. The contribution of their parents, siblings, teachers then other people's play very important role in their life to mix with normal people. On other hand this a reality that deaf or hard-of-hearing people have their own culture, environment, and communication language (sign language see session C) which is totally different from normal people. This segregation makes a deaf or hard-of-hearing individual less motivated about the any area of society.

4. Cultural Issues

It has been observed in most families in the city or in pastoral areas that the attitude towards deaf or hard-of-hearing peoples is the cause of disrespect or a mean of mocking among friends. It is a cultural hindrance that made a special person bounded.

5. Organizational Issues

Fortunately, if an individual from a deaf or hard-of-hearing community gets education with the support of their parents, when he/she enters their practical life and plans to choose a profession they face lot of issues. There is job quota for them but due to lack of awareness and knowledge they are not able to join good organization similarly on other the management and the staff of an organization are not trained or familiar to the stagey how to deal with these peoples. Sometimes it is observed that the organization deliberately avoids the hiring of special needs people as they do not them as a part of their organization and the concept behind this is that they think their ability is lesser than normal people and due to lack of communication the reputation of the organization will be led down.

B. BARRIERS AND CHALLENGES FACED BY DEAF OR HARD-OF-HEARING PEOPLE DURING SEARHING AND DOING EMPLOYMENT

This is identified during the research on deaf or hard-of-hearing people following are the major barriers or challenges which they faced when they start or try to search job in market.

- No training for deaf or hard-of-hearing before starting the career.
- There are very less training centers in less developed countries and the cost of training is not bearable for them.
- Social behavior towards deaf or hard-of-hearing peoples is not very positive.
- Very few deaf or hard-of-hearing people get proper education. The rate of higher education in less developed countries for deaf or hard-of-hearing is very low and they have less job opportunities.
- Law and act is offered but due to lack of awareness amongst normal people and deaf or hard-of-hearing people there is barrier for them.
- Due to the above point this quite impossible at managerial posts to handle people with disability of defenses or hard-of-hearing.

C. SIGN LANGUAGE

It is a language used by the people who are hearing impaired to communicate with each other and the outside world which helps them to live their daily life. It was first considered as a language by Juan Pabola de Bonet in 1620 who published a book on sign language learning about how to learn sign language. This work of Juan was based on the great earing people work based on the work of Italian, language. This work of Juan was based on the great earing people work based on the work of Italian, physician Girolamo Cardano who was the pioneer of the concept that words are not necessary to understand any idea [6]. To get an idea on how sign language does looks like there are few basic signs show in figure 1

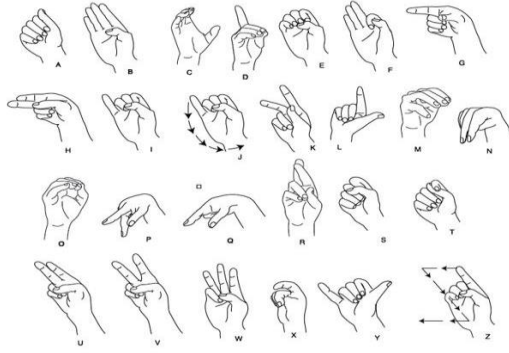


Fig. 1 Basic sign language [7-9]

D. PAKISTAN SIGN LANGUAGE

Pakistan sign Language was introduced primarily by a TV show “Boltey Haath” means talking hands and afterwards it has been

documented. These days lot work has been in progress to use signs along with technology, for instance several mobile based applications are there to teach or to understand the sign language easily.

Figure 1: Sign Language communication medium of deaf or hard-of-hearing

Sign language is a language for deaf or hard-of-hearing people but awkwardly in Pakistan, sign language is not familiar by many deaf or hard-of-hearing people particularly those living in the rural areas. Therefore, many deaf people face difficulty to communicate with others.

For this purpose, Pakistan Association of the Deaf (member of world Federation of the Deaf and Asia-Pacific Development Center on Disability and Family Education Services Foundation (FESF) and other are working and research on deaf culture and Sign Language. But still different types of sign languages are used in different places of Pakistan and there are still needs to standardize the Pakistani

According to Ramakrishnan four factors that affect the employment of disables, employment policy or rules imposed by government should be revised incorporating the rules for the disabled person’s employment [6].

These are namely, the organizational commitment to employment of disabled people, attitude towards disabled workers, the organizational policies on disability, and the employment opportunities for the disabled people. A deaf or hard-of-hearing can do worker as a normal can do but the need of training

Sign Language (PSL) at regime level. Urdu alphabets and numbers in PSL are shown in figure-2 and figure-3.



Figure 2: Alphabets of Pakistani Sign language (PSL) [7-9]



Figure 3: Number System in Urdu Sign Language [10]

II. RELATED WORK

Disability is not an issue, but the actual problem is, how to deal with it. Firstly, we should identify the factors that are the main hindrance in the employment of deaf people.

and a proper education system for them is required. Pamela Luft identifies communication barriers special on site when employee has to answer the queries of managers or of other co-workers. In developing countries, 80% to 90% countries the figure is between 50% and 70% [11].

Usually in developed countries, two years after graduation from high school, only 24% of deaf individuals start working full-time and 38% were attending postsecondary training but in underdeveloped countries like Pakistan the

situation is very bad at postsecondary level. In Pakistan, more than 66% of children are enrolled in primary schools, leaving 34% without education. Although a 2% employment quota has been set for individuals with disabilities, this allocation is inadequate to fully support their integration into the workforce.

For deaf people there should be some employment policy following any as specified in for instance Sheltered Employment Model in which a place is provided to deaf people to work, and wages are given them based on time they spend for work. Charles C. Coker et al [12] discussed other models like Enclave, affirmative implemented [13].

COMPARISON OF EMPLOYMENT MODEL FOR DEAF OR HARD-OF-HEARING PEOPLE

The following works significantly contribute to the development of inclusive systems for individuals with disabilities using information technology in areas such as domain conversion, sign language, interactive employment models, and Urdu sign language (as detailed in Table 3).

Proposed Models	Year	Features		
		Technology	Environment	Technique
Interactive Employment Model to Assimilate the Deaf persons in workplace by using ICT [14]	2013	Microphone, computers	Flexible	Language conversion into signs
Sign Language Information Detection through Mobile or Telephonic Communication [15].	2013	Mobile/Telephone	Flexible	Language conversion into both sign and natural language
Conversion of Heterogeneous Education System (HeES) into Homogeneous Education System (HoES) for ease of Disables using Information Technology [16]	2010	Microphone, computers	Flexible	Language conversion into both sign and natural language
Affirmative Industry Model	1990	Theoretical framework	Flexible	Both Normal and disable peoples work as a mix
Enclaves	1986	Theoretical framework	Flexible	Group of special peoples work as unit on permanent basis
Mobile Work Crew Model	1969	Theoretical framework	Flexible	Group of special peoples work as a unit.
Sheltered Employment Model	1939	Theoretical framework	Restricted environment with closed rooms.	Special peoples are provided some work like paper shredding.

Table III Comparison of Employment Model for Deaf or hard-of-hearing people

DI. OFFERED MODEL

Mostly the research work done in area of deaf or hard-of-hearing peoples are emphasis on rights of

disables but the important need in there is employment policy which are ignored badly.

The offered model in this research proposed a Technology based Interactive Employment Model for deaf or hard-of-hearing people. This paper describes a technology-based model.

which provides a source of employment for deaf or hard-of-hearing people. The same technological system can be used for providing multipurpose employment for deaf communities.

WORKING STEPS OF OFFERED MODEL

Technology based Employment Model (TbEM) can be implemented in any restaurants/hotels to support deaf or hard-of-hearing people as a customer's/guests, waiters or cook/chef following are the working steps of offered TbEM.

- Restaurant has Separate dining tables for customers.
- Smart devices are attached to each dining table.
- Customers/guest can select the items from the menu by three different options.
 - by touching the picture
 - by entering as text
 - by selecting from the dropdown menu.
- The selected menu will transfer on waiters through technology-based device.
- A deaf waiter can forward the order in the kitchen or chef/cook using the same device for further process.
- A deaf chef/cook can receive order directly on its own technology-based device (mobile) as a translated version in sign language.
- Customers/guests can order their desires additional items as per need.
- In case of deaf customers/guests can directly communication with deaf waiters in their own language i.e., sign language without any barrier.
- Additional in case of normal customers/guests rings a bell button with different light red/green is placed to call the deaf waiter.

DII. PROPOSED RESEARCH METHODOLOGIES

The proposed model consists of both software and hardware as a technology. A technology-based device (smart phone, tablet etc. or specially designed device for deaf people) is installed on each dining table.

The device will be constructed specially for the purpose of ordering deaf or hard-of-hearing people. Though this device customers/guest can order with the user-friendly software interface that relates to the same hardware installed at kitchen or cook/chef.

After receiving the menu, the cook/chef starts working on cooking. All the communication through the system is translate into both sign language and any natural language (in the system English is used as a natural language). Interface of the software is designed in such a way that both normal and deaf or hard-of-hearing peoples can use the device easily [6]. (Figure-4 shows the working of model)

DIII. PROMINENT FEATURE OF MODEL

Features of the model

This model is based on the thought that there should be a homogenous work environment for both normal and deaf or hard-of-hearing peoples work/communiante together. Main features of the propped model are as below:

A. Use of Technology

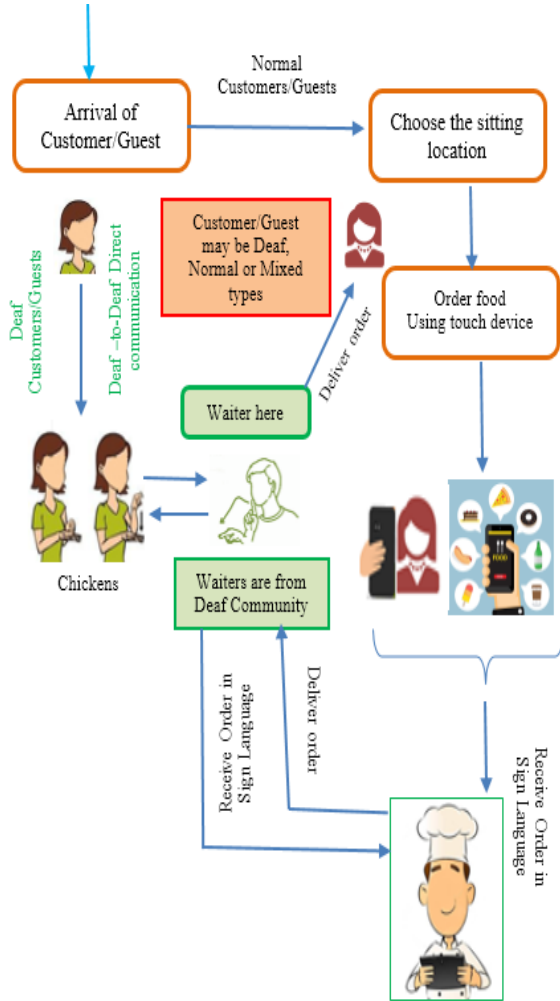
This is a technology-based era and almost everyone may use a mobile. Smart devices are available in cheap prices, so researchers are trying to use this facility in every discipline of life. At homes, in factories, organizations and educational institutions this latest technology along with variety of smart devices is in use, even in hospitals one can register the various types of uses of different devices. Wi-Fi based communication has become very common now a day so the order can directly be transferred to cook/chef.

B. Easy to Use

The specially constructed device suggests very less buttons like SELECT, EDIT, CONFIRM and CALL so that both the normal and deaf or hard-of-hearing can easily operate the device and

communicate with each other. Software interface should also be use friendly and translate the orders or other instruction.

Figure 4: Technology based Employment Model (TbEM) for Deaf and Hard-of-Hearing people



C. Homogeneous Employment System

The proposed system has the advantage that deaf people can work with normal people without any discrimination. Technology based system is not only efficient but used to have an easy-to-use interface which removes the need of voice-based communication. This system provides a homogeneous environment where both normal and deaf or hard-working people can work together.

D. Fast and Easy Communication

Our system has internet-based communication. network, however, customers can place orders

directly as in a usual manner by pressing buttons or by marking the items printed on a paper. Specific colors of light will indicate what a customer wants if he/she wants to ask any question a red light can be used for the purpose otherwise we have proposed two colored light stripes orange for re-ordering and green for confirmation of order. However, against the red light a query list can be prepared in advance consists of frequently asked questions both in textual and symbolic form.

E. Psedocode

This pseudocode outlines a restaurant system designed for both deaf and hearing individuals, integrating smart devices at dining tables. Customers can place orders through a user-friendly menu interface, which are then processed by waiters, with translation into sign language if needed. Orders are forwarded to the kitchen, where chefs, including deaf chefs, receive them in their preferred language format. Additional orders can be placed seamlessly, and deaf customers can communicate directly in sign language, while hearing customers use a bell system to call waiters. The process runs continuously while the restaurant is open, ensuring an inclusive and efficient dining experience.

```

BEGIN
  SETUP restaurant with smart devices
  FUNCTION Customer_Order()
    SHOW menu, GET choice, SEND order to waiter
  END FUNCTION
  FUNCTION Waiter_Processing()
    GET order, TRANSLATE if needed,
    SEND to kitchen
  END FUNCTION
  FUNCTION Chef_Processing()
    GET order, SHOW in preferred language,
    START cooking
  END FUNCTION
  FUNCTION Customer_Communication()
    IF deaf THEN USE sign language ELSE
    PRESS bell
  END FUNCTION
  WHILE restaurant is open
    CALL Customer_Order(),
    Waiter_Processing(), Chef_Processing(),
    Customer_Communication()
  END WHILE
END
  
```

DIV. RESULTS AND DISCUSSION

The Technology-based Employment Model (TbEM) was tested in a restaurant setup to see how well it improves communication and workflow for both deaf and hearing individuals. In a simulated environment, deaf waiters, chefs, and customers used the smart-device system to interact. The results showed that technology made communication easier, reduced the need for interpreters, and helped remove barriers in jobs and services.

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CONFLICT OF INTEREST

There is no conflict of interest between the authors. This work was conducted without any external funding.

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