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A Study on the Difficulty of Communication through Sign Language in Non-English Speaking Countries

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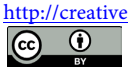

Abstract

Sign language is a visual language that conveys intentions through physical signals, including movements as like hands and eyes, based on existing spoken languages. Communication in sign language generally involves combinations of shapes drawn with fingers or arms, their position and movement, and facial expressions (Padden, 1990). As hearing-impaired people grow and with increased availability of receiving education, many also learn sign languages in addition to spoken languages (Lucas, & Valli 1992). In these cases, lip shapes or sounds can be used to supplement communication, but sign language remains the primary language for most hearing-impaired people, with spoken languages playing a secondary role. Sign language is a distinct language and should not be confused with non-verbal communication systems such as body language. A common misconception is that sign language is a universal language (Lillo, 2010). For example, signals used in sports games or specific organizations are not considered sign language. To clarify this distinction and improve conditions for hearing impaired people, some countries designate sign language as an official language, allowing them to access more diverse and abundant information. This misconception arises from the prejudice that sign language is no different from body language, and many people who hold this belief overlook the fact that body language vary depending on region and culture. Therefore, in search of limitations of sign language in communicating by English-language based technical terms, this study will explore the ability of spoken language and sign language customers to express the problem through analyzing the electronics product put into two groups for after service and their disadvantages through communication duration with customer agents as well as success frequency of solving the problem in quantitative data.

Keywords

Sign Language, Hearing-Impaired, The Deaf, ASL, Arabic Sign Language, Sign Language Interpreter

1. Introduction

Hearing-impaired persons refer to people who have disabilities related to their hearing. According to study of Ceil (1990), this can be categorized into those born with congenital disabilities and those who acquire disabilities through illnesses or accidents later in life. This study focuses primarily on people with congenital disabilities who lack understanding and experience with spoken language.

Generally, we refer to people with hearing impairments as "hearing-impaired persons" or "deaf persons". However, the term "hearie" is sometimes used in daily life, which can have a derogatory connotation. Because of these societal perceptions, hearing disability has become a significant setback that refrains one from getting involved in society. A person with hearing impairment refers to someone with a hearing disability. This can be categorized into those born with congenital disabilities and those who acquire disabilities through illnesses or accidents later in life. This study focuses primarily on people with congenital disabilities who lack understanding and experience with spoken language (Senghas & Monaghan, 2002).

Loanwords are words borrowed from foreign languages and integrated into the original language through various processes such as pronunciation, written text, source language, or through a third intermediate language. Some loanwords have been borrowed so long ago that they now function as part of the native language, while others have been borrowed more recently and are not yet widely used (Elibiad, 1985).

The influx of loanwords is often evident in IT-related terms, particularly in technical jargon and specific products and components. The most common issue with IT products includes poor battery life, overheating, connection problems, microphone malfunctioning after being exposed to moisture or storage space running out. Words such as Microphone, written as ميكروفون are pronounced similarly as English, mikrufun. This also applies to words such as battery and Wi-Fi. This shows how the words used the most to solve their issue is directly adopted from English that requires the consumers to understand the loanwords.

Microphone— ميكروفون (mikrufun)

Battery— بطارية (bataaria)

Wi-Fi— واي فاي (way fay)

In some cases, loanwords comprise the majority of the vocabulary used to describe and utilize these products (Petronio, 1995). For example, signals used in sports games or specific organizations are not considered sign language. To clarify this distinction and improve conditions for hearing impaired people, some

countries designate sign language as an official language, allowing them to access more diverse and abundant information

The recent advancement of IT technology has led to the development of many devices and applications to aid communication for hearing-impaired persons. However, these technological advancements can also present challenges (Al-Seghayer, 2001).

In particular, hearing-impaired persons in non-English-speaking countries often face a "double translation" environment as the latest IT products and technologies are based on English terms (Dean, 2005).

For example, in Arabic, "smartphone" is هاتف ذكي when translated phonetically, but the commonly used term in daily life is هاتف. In this case, hearing-impaired persons in Arabic-speaking countries need to learn the sign for هاتف ذكي instead of هاتف, which can be confusing as the sign for هاتف is also used for a landline phone.

Moreover, when a smartphone malfunctions and needs repair, it can be challenging to describe the issue in Arabic sign language due to the lack of signs for specific parts or problems, resulting in frequent miscommunication and delays.

This study focuses on non-English-speaking countries (centered on Arabic-speaking countries) and when using IT (information technology) and CE (consumer electronics) products or parts composed of loanwords, we aim to examine the current limitations of sign language and identify the inconveniences and communicative limitations that hearing impaired persons face when using sign language through the following three comparisons: comparison between residents of large cities and small and medium-sized cities, comparison depending on the ability to use English, comparison based on product categories (IT products vs. CE products).

In particular, the reason for including the ability to use English in the study is that most functions of IT and CE products are expressed in English words, and many words are derived from English. CE products are household items that have been used by people for a long time that lead development of words according to products through its prevalence therefore, can be described within the range of spoken language without having trouble expressing the problems. We aim to examine the impact of this on non-English speaking countries' sign language communication and identify problems and solutions to lay the foundation for future improvements in their convenience due to technological advancements.

2. Materials and Methods

2.1. Sample (Research Subjects)

This study was conducted from two different time periods, targeting hearing-impaired customers (using Arabic sign language) and general customers residing in Saudi Arabia who contacted the electronics company service center. The number of participants and their ability to use English by city as **Table 1**.

- Subjects: a total of 280 people (140 hearing-impaired customers, 140 general customers).

Table 1. English speakers and English possible sign language speakers by city of Saudi Arabia.

		Total	English possible in Spoken language	English possible in Sign language
Big City	Riyadh	98	24	11
	Jeddah	48	18	6
	Dammam	38	11	8
Mid-City	Mekka	26	5	1
	Medina	22	4	3
	Khamis	30	6	2
	Buraydah	12	3	-
Small City	Others	10	2	2
Total		280	73	33

- Sample: 140 spoken language customers were selected, with an equal number of spoken language customers from the same product and city.
- Period: July 4, 2021, to August 6, 2021 (5 weeks).
  June 16, 2022, to August 4, 2022 (8 weeks).
- Location: Riyadh, Kingdom of Saudi Arabia.

2.2. Research Method

Since the high supply of smartphones around the world in the late 20th century, words used to describe parts and mechanisms of IT products have developed around the English language. CE products, however, have been used by people for a long time, thus numerous technical terms exist in specific country's spoken language. This means, around 504,000 people of Saudi Arabia, which makes up about 1.4% of the whole its population, are having potential disadvantages when it comes to fixing their IT products. The number 1.4 might seem insignificant, but thinking about the impact the IT products, especially smartphones, bring to our lives fulfills the values of this study.

This study aimed to determine how effectively non-English speaking countries can communicate using sign language for broken IT/CE products and their usage dissatisfaction.

Cross-cultural exchanges between deaf and hearing persons are replete with unintentional misunderstandings and even purposeful acts of oppression. Sign language interpreters routinely bear witness to the negative emotional fallout of these dynamics on the Deaf consumer (Harvey, 2003).

Broken products were divided into IT products (mainly smartphones) and CE products (TVs, refrigerators, washing machines), and the effect of English usage on communication was also reviewed, distinguishing between cases where hearing impaired persons could and could not use English.

The research was conducted in a format observing the communication process

between an Arabic sign language interpreter and hearing-impaired persons, and due to COVID-19 restrictions during the research period, all communication was conducted through video chat.

2.3. Data Analysis

① Comparison of the time it takes for a sign language interpreter to understand the problem after consultation between spoken language and sign language speakers.

② Comparison of the time it takes for hearing impaired persons to understand the self-check method suggested by the sign language interpreter for problem confirmation between spoken language and sign language speakers.

③ Comparison of communication time when the problem area and symptoms need to be expressed in English words and when they do not between sign language speakers who can understand English and sign language speakers who cannot understand English.

④ Comparison of the time it takes for hearing impaired persons to understand the sign language interpreter's explanation in cases where there is no actual problem between sign language speakers who can understand English and sign language speakers who cannot understand English.

⑤ Comparison of the communication duration between face covered with niqab (mask) and face opened. The counseling with face cover was conducted by a female agent wearing traditional Arab clothing, and the counseling without face cover was carried out by male agent in Arabic.

3. Results

This section shows experimental data, measurements, and observations. No explanations or interpretations are expected in this section and that information needs to be addressed in the discussion section. All tables, figures, and equations should be located in the proper positions and all descriptive explanation needs to be referred from the context in the body.

Comparison of the time it takes for a sign language interpreter to understand the problem after consultation begins.

According to **Table 2** below, there is no significant difference in the time it takes for a sign language interpreter to understand the description of the malfunction part. However, there is a noticeable difference in the time it takes for them to understand the description of symptoms that hearing impaired persons actually perceive as malfunctions or find inconvenient to use, depending on the product category.

In particular, hearing-impaired persons had difficulty explaining software-related problems rather than hardware-related problems and complaints in IT products, and sign language interpreters had to ask an average of 3 additional questions during communication.

Sign language interpreters may not possess specialized knowledge about the specific product in question, which means they often need to communicate with

Table 2. Elapsed time comparison between spoken language and sign language for communication with agent of call center.

	Product	Spoken language	Sign language	Gap
Issue recognition	Smartphone	00:47	03:11	02:24
	TV	01:13	02:34	01:21
	Refrigerator	01:56	02:41	00:45
	Washing machine	01:32	02:51	01:19
Issue Replay	Smartphone	02:11	04:51	02:40
	TV	02:16	03:18	01:02
	Refrigerator	02:24	03:14	00:50
	Washing machine	02:19	03:51	01:32
Self-diagnostics	Smartphone	02:15	06:48	04:33
	TV	01:59	05:17	03:18
	Refrigerator	02:10	04:36	02:26
	Washing machine	01:54	04:43	02:49

other technical consultants within the call center for additional verification. As a result, the consultation time can take up to an average of 2.56 times longer than that of a typical phone consultation.

Comparison of the time it takes for hearing impaired persons to understand the self-check method suggested by the sign language interpreter for problem confirmation between spoken language and sign language speakers.

Generally, it is necessary to check how often a problem occurs and under what circumstances it is reproduced.

In reality, there are cases where customers think there is a problem, but it's not actually a malfunction. Such cases may arise when customers do not fully understand how to use the product. Additionally, there are cases where customers may feel dissatisfied when using the product, but when considering the product design and functionality of the product, it is deemed normal.

In these cases, self-diagnostics or reproducing the usage environment is required. Both of these tasks took a long time for sign language interpreters to explain to hearing impaired persons, and 107 out of 140 cases (76.4%) involved hearing impaired persons not understanding the self-diagnostics or reproducing the usage environment properly.

The reasons why hearing-impaired persons may not fully understand includes not being familiar with the terminology of the relevant product parts, accounting for 49.2% of cases according to Table 3, and an inability to communicate about reproducing the problem, accounting for 40.7% of cases.

Comparison of communication time when the problem area and symptoms need to be expressed in English words and when they do not between sign language speakers who can understand English and sign language speakers who cannot understand English.

Table 3. Possibility by Spoken language and sign language.

	Product	Spoken language	Sign language	Gap
Issue recognition	Smartphone	88/91	44/91	44
	TV	20/21	11/21	9
	Refrigerator	14/15	9/15	5
	Washing machine	12/13	8/13	4
Issue Replay	Smartphone	65/91	32/91	33
	TV	18/21	9/21	9
	Refrigerator	14/15	8/15	6
	Washing machine	10/13	5/13	5
Self-diagnostics	Smartphone	47/91	18/91	29
	TV	18/21	4/21	14
	Refrigerator	11/15	6/15	5
	Washing machine	10/13	7/13	3

As with the results of study ②, when hearing impaired persons were unfamiliar with the terminology for a specific part, 87% of the cases involved the term being a loanword. Among these cases, 42% were words that existed only in English and not in Arabic. Furthermore, even if the word existed in English, 26% of cases involved a lack of sign language representation for the term, leading to communication difficulties as Table 4.

According to the National Association of the Deaf's American Sign Language Dictionary, there are approximately 10,000 words expressed in sign language, which is only 5.9% considering there are 170,000 actual English words. Furthermore, when comparing the vocabulary used in daily life, English has 20,000 to 35,000 words, while sign language has only about 3,000. As a result, many English words do not have a corresponding sign and are often represented using finger spelling (Meier, 1990).

According to research (Ryding, 1987), for Arabic, which has 100,000 words, according to The Standard Arabic Sign Language Dictionary, there are only 1216 registered sign language words. This shows that the number of words that can be expressed in sign language is significantly lower than that of English.

In particular, in the case of IT products, there have been instances where issues with smartphone software could be expressed with a single word in spoken English, but there were no corresponding spoken Arabic or Arabic sign language terms available, making it difficult to identify the problem.

Comparison of the time it takes for hearing impaired persons to understand the sign language interpreter's explanation in cases where there is no actual problem between sign language speakers who can understand English and sign language speakers who cannot understand English.

Table 4. Possibility[*1] by English and Arabic/English.

	Product	English only	Arabic/English	Gap
Issue symptom	Smartphone	32/91	39/91	7
	TV	12/21	14/21	2
	Refrigerator	8/15	14/15	6
	Washing machine	7/13	12/13	5
Issue product	Smartphone	44/91	48/91	4
	TV	14/21	15/21	1
	Refrigerator	8/15	8/15	-
	Washing machine	9/13	10/13	1
Repair method	Smartphone	24/91	48/91	24
	TV	7/21	20/21	13
	Refrigerator	8/15	11/15	3
	Washing machine	6/13	13/13	7

[*1]Possibility means that understanding and verifying issues by agent; *When repairing, customers have several options with IT products with small volume: walk-in, dhl/fedex; *For CE products, technicians have to visit customer's home due to its volume and weight.

If, through the above procedure, the sign language interpreter ultimately determines that there is a problem with the hearing-impaired person's product, a repair technician may either visit the location to fix the issue or collect the product and repair it at a service center, depending on the size of the product and the nature of the problem (Logan, 1988).

However, if the product's malfunction status and symptoms are not definitively confirmed, it is impossible to know which part is faulty, and a repair technician must visit to assess the issue, in such cases, at least two visits are required. For the manufacturer, this means they have to cover the labor cost for the technician's two visits, which can be a financial burden. As a result, manufacturers may be reluctant to provide this service, ultimately acting as a significant obstacle for hearing impaired persons to receive timely repairs.

As seen in Table 5, it took an average of 1 minute and 40 seconds longer for a sign language interpreter to convince a hearing-impaired person that the product's function was normal without identifying the faulty part. In particular, when the product's defect and symptoms could only be expressed in English, it took an average of 3 minutes and 40 seconds longer, which is 2 minutes more than when the issue could be expressed in Arabic as well.

Moreover, as seen in Table 6, in cases where hearing impaired persons understood from the sign language interpreter's explanation during the first service that there was no malfunction but still felt discomfort and sought a follow-up consultation within a week, 24.3% of these cases were for issues expressed in Arabic, while 45% were for issues expressed only in English. This indicates that there was a 20.7% higher occurrence for cases expressed solely in English.

Table 5. Non defect found case.

	Product	Spoken language	Sign language	Gap
Issue in Arabic	Smartphone	03:27	06:14	02:47
	TV	03:16	04:27	01:11
	Refrigerator	03:05	05:15	02:10
	Washing machine	02:48	05:26	02:38
Issue in English	Smartphone	02:09	07:07	04:58
	TV	03:25	05:46	02:21
	Refrigerator	04:56	06:12	01:16
	Washing machine	05:08	05:53	00:45

Table 6. Repeated repair case.

(a)

	Product	Spoken language	Sign language	Gap
Issue in Arabic	Smartphone	02:27	05:14	02:47
	TV	03:16	04:27	01:11
	Refrigerator	04:05	04:25	00:20
	Washing machine	03:48	04:26	00:38
Issue in English	Smartphone	02:09	07:07	04:58
	TV	03:25	06:46	03:21
	Refrigerator	04:56	05:42	00:46
	Washing machine	05:08	05:53	00:45

(b)

	Product	Spoken language	Sign language	Gap
Issue in Arabic	Smartphone	8/91	29[*1]/91	19
	TV	3/21	11/21	8
	Refrigerator	4/15	07/15	3
	Washing machine	5/13	09/13	4
Issue in English	Smartphone	14/91	41/91	27
	TV	4/21	16/21	12
	Refrigerator	4/15	27/15	13
	Washing machine	5/13	16/13	11

[*1]The incidence of repeated repair (it was not repaired completely at once).

In cases where follow-up consultations were sought, no significant difference was found between IT products and CE products. This ultimately indicates that proper communication between the sign language interpreter and the hear-

ing-impaired person did not occur during the initial consultation.

Comparison of the communication time it takes for face covered and face opened.

Through a comparison of deaf and hearing learners, the efficacy of print as a source of linguistic input is explored in relation to the role of phonological knowledge in decoding text. Unlike hearing second-language (L2) learners, who have phonological knowledge of their spoken first language (L1), deaf learners often do not have (well-developed) phonological knowledge of a spoken language because they typically rely on vision rather than hearing for the processing of linguistic input.1 Under these conditions, deaf learners' development of English language and literacy skills tends to be sorely deficient (Fischer, 1998).

Saudi Arabia is one of the Gulf Cooperation Council and most of the women wear traditional clothes called a bay as that are wide and long robes, and a Shayla hijab (scarf) along with a niqab (mask) that covers most of their face.

In this case, most of the faces except eyes are covered by traditional clothes, and this is a very good opportunity to check objectively how much lip motion and facial expression can affect the communication of sign language.

As the chart below shows the elapsed time of an agent who does not wear a niqab (mask) and who wears niqab.

According to the data as **Table 7**, wearing niqab did not affect the consultation time in spoken language, however, it showed significant increase in consultation time in sign language with 31% in NDP and 49% in DP with both wearing niqabs compared to without niqab. This, as a result, in sign language, not only hand motions but also lip motion as well as facial expression greatly impacts the problem verification as a whole.

4. Discussion

As a result of the survey conducted with 140 sign language speakers and 140 general spoken language speakers, it was found that when seeking consultation for electronic product repairs at a call center, sign language users take more time than spoken language users to explain the product's malfunction or defect and to understand the corresponding repair solutions. This demonstrates that communication is less smooth for sign language users.

Additionally, it took more time with sign language to recognize the possibilities of impaired parts of the products. Especially for smartphones, consultation time took 1.5 to 2 times more compared to CE products because most of the terms describing failure symptoms and issues are in English.

With the increasing use of English in the functions and usage of IT products such as smartphones, as well as traditional home appliances like TVs and refrigerators, non-English speaking countries (in this study, Arabic-speaking countries) have found that sign language users are affected in their communication with call center agents for problem identification and resolution.

In the case of spoken language, even if a word is not translated into Arabic, it can become established in society as a loanword and used universally, making

Table 7. Elapsed time with niqab versus without niqab.

	Case	Spoken language	Sign language	Gap
With niqab	NDF[*1]	1:51	6:22	4:31
	DF[*2]	1:46	7:16	5:30
Without niqab	NDF	1:42	4:25	2:43
	DF	2:02	3:44	1:42

[*1]NDF: No defect found; [*2]DF: Defect found.

translation into Arabic unnecessary. However, for sign language, there are many instances where translating an English word into Arabic sign language is not possible, and even translated signs may not be interpreted or widely used as borrowed signs within the community. This confirms that there are significant communication issues for sign language users (Ryding, 1987).

Moreover, when there is no sign language equivalent for an English word, the English alphabet can be expressed in sign language. However, in many cases, communication is still not possible because a significant number of sign language users do not know English.

However, depending on the agent's linguistic comprehension, ability to understand the problem as well as experience in the service field, there may be a difference in delivering a solution method (Bochner & Bochner, 2009). Sign language agents participating in this experiment had an average of 5.1 years of using sign language. Yet, it is hard to state that those agents have enough experience and performance since they have worked only about 1 year in the service department with basic training with techniques and parts used in electronic products.

Considering that there are people who must communicate through sign language and experience difficulties in the current product repair process, it is essential to find more proactive and effective ways to improve communication through sign language.

In other words, for the hearing impaired kid, who may be socially isolated and disadvantaged in the information age, access to information and services related to their daily lives is directly linked to improving their quality of life (Reagan, 1985). Therefore, governments should recognize these issues, continuously work on discovering additional languages that can be expressed in the country's sign language, and provide user education in parallel.

Last but not least, according to study of Klima & Bellugi (1979), sign language is considered as one of body language with hands in the majority of cases, however, the previous research about lip motion and facial expression demonstrates great effect on communication of sign language (Padden, 1990).

Motion recognition technology is already developed yet converting motion to text is still facing limitations because sign language is different from body language and most of the applications and videos are focusing on hand gestures. Therefore, application developers or engineers should understand sign language is not only hand motion but also one of the languages with facial expression with

lip motion which is a key objective of motion tracking In this section, observed results and data should be interpreted concisely. In addition, the authors need to explain the significance of the research findings and revisit the hypothesis described in the introduction.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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