An exploration of Deaf telecommunication processes and associated social issues in South Africa

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ABSTRACT

This paper presents the results of an exploratory investigation into telecommunications practices and challenges among the Deaf in South Africa.

Telecommunication products like cell phones, TTY's, sMessage terminals, e-mail, fax messaging, instant messaging (IM) were some of the technologies investigated. The research shows that the Deaf considers IM as the most successful technology for both business and social communication. E-mail was rated most often used for business communication, where as e-mail and SMS were rated most used for social communication. The main drawbacks experienced by deaf users of telecommunications technologies related to connecting with and understanding of people.

The research findings indicate that the Deaf would like to see heightened public awareness of deafness and its challenges in telecommunication.

CATEGORIES AND SUBJECT DESCRIPTORS

K4 [**Computers and Society**]

K4.2 [**Social Issues**]

KEYWORDS

Deaf Telecommunication; Hearing loss; Social Factors.

1. INTRODUCTION

Alexander Graham Bell invented the telephone in 1876 after his mother's gradual loss of hearing stimulated his interest in acoustics. Ironically, his invention caused the Deaf to be excluded from participating in the main form of communication in the world, telephonic communication, for a number of decades until the first general purpose Teletype-writer (TTY) for the Deaf was developed from military technologies [16].

Statistics on disability in South Africa (including hearing disability) tend to be fragmented and contradictory. The most recent comprehensive Statistics South Africa survey (2001) to include data on disability in South Africa reported that 2,2 million persons (5% of the population) were disabled [18]. In a more recent release on household statistics, 3,4% of the total population is estimated to be disabled [17]. This figure may be an underestimation, as the question in the survey was formulated to reflect a 'limitation in daily activities' due to disability, which obviously would exclude those who have overcome the limitations of disability in terms of their daily activities. Of those with disabilities, the 2001 estimate is that 313 600 or 14,3% of disabled persons have hearing disability (either deaf or hard of hearing). As an example of existing contradictions in the available statistics this number could be compared to earlier numbers that indicate that approximately 1,6 million South Africans use South African Sign language as their first language [5]. Despite these contradictions related to the actual numbers of affected South Africans the problem does seem to be significant.

Information and Communication Technology (ICT) has a history of significant impacts on the ability of the Deaf to communicate – also in South Africa. Technologies relevant to this paper include the TTY (the oldest assistive device still in use), fax-messaging, Short Message Services (SMS) and Internet-based telecommunication options – notably e-mail and instant messaging (IM).

Although each of these technologies facilitates communication for the Deaf, each has unique problems, social dilemmas and other restrictions which the Deaf has to deal with.

The American National Association of the Deaf distinguishes between 'deaf', which is the audiological condition of not being able to hear; and 'Deaf', which is the community that consists of either deaf and/or hard-of-hearing (HOH) individuals who share a communal set of beliefs and values. A HOH person's audiological condition is not as severe - s/he has some hearing left, and is able to use it to communicate. This paper uses the terms "Deaf" or "deaf individuals" interchangeably to refer to all deaf and HOH individuals in South Africa.

Despite significant development and improvement of telecommunication devices that benefit the Deaf, information on how the South African Deaf actually use these in their lives is largely missing. Some studies were undertaken in Australia

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and the UK but not in South-Africa. Research is therefore necessary to determine whether the implementation of the Deaf Telecommunication technologies resulted in the intended benefits for South African Deaf users.

This paper focuses on exploring the impact of ICT and social factors on Deaf Telecommunication practices in South Africa.

The following questions are addressed in this paper: Which Telecommunication devices are available to the Deaf in South Africa? If used, how are these Telecommunication devices being used? What are the perceived drawbacks or limitations of these Telecommunication devices amongst deaf users? What social factors impact on the Deaf Telecommunication process?

The research project was of a limited exploratory nature. The various limitations are discussed in Section 3.3.

This research paper has been structured in two main parts: Firstly we present a broad literature review of devices available for Deaf Telecommunication; secondly we present, analyze and discuss the results of questionnaires that obtained feedback from Deaf individuals regarding Deaf Telecommunication in South Africa.

2. BACKGROUND

A brief synopsis of Telecommunication devices available to the Deaf is presented in this section. These include the Teletype writer (TTY), Mobile SMS, mobile and telephone calls, the sMessage Terminal, e-mail, fax and Instant Messaging (IM).

2.1 Teletype writer (TTY)

The only deaf-specific telecommunication product, the TTY, adapted from military technology for use by the Deaf [16] has a long history of use. It involves a telephone with a keyboard on which the user will type out a message and send it in real-time to the recipient, who can reply in a similar manner. A TTY-type product is available in South Africa. This device represents an important synchronous means of Deaf communication that does not require Internet connectivity.

In a three-month field trail, Glaser [4] tested the local TTY device with deaf and hearing users in Western Cape. Various technical and social issues surfaced, such as *"[d]eaf persons have reduced literacy, making the understanding of text difficult"* and that there are *"insufficient (devices) in public places"*. Also, the Deaf make extensive use of nonstandard abbreviations and language structures ("deaf speech") that are commonly known in the Deaf community, but might not be understood by hearing individuals, thus reducing the potential for shared use of TTY's by deaf and non-deaf users.

The main drawback of the TTY however is that both the sender and receiver should have a TTY installed to make communication possible.

In a study done in Britain, a number of libraries were forced to offer a TTY-type service in addition to normal services [9]. The feedback was mostly negative - librarians complained of an increased workload and could not understand the reason for implementing this service. Another study done in Australia showed that few companies are using TTY devices for communications. Where these facilities are available, operators are not aware of it or unfamiliar with its usage [15].

In South Africa, TTY technology is considered to be a "dying business". As reported by the only supplier of this product, there were only three TTY-devices sold in nine months (January-September 2008) and the Deaf mostly ordered these as replacements. With assistance of the service provider, TTY-devices were installed at a well-known South-African grocery chain, who claimed to never have received any calls from deaf individuals.

The discussion of the TTY device highlights two main problems: 1) Hearing individuals are not motivated to buy or use a deaf-only product if they do not also perceive personal benefits from its use. For social reasons it is therefore problematic to eliminate the TTY's general drawback of both the sender and receiver having to have a TTY installed - the Deaf will still be excluded if they cannot contact hearing individuals who are not interested in using it. 2) A lack of awareness of the product through under-advertising and/or social ignorance may also have contributed to its ultimate failure.

2.2 sMessage Terminal

The sMessage service was first used in December 2004. This service enables a land-line based SMS service for users with a CLI (Calling Line Identification) subscription. Similar to SMS, it can handle 160 characters and the recipient will receive a notification of any messages received.

When the sMessage service was first introduced in South Africa customers had to register for the CLI service and in addition had to purchase an sMessage terminal if they wanted to be able to type SMS's. Those who didn't have an sMessage Terminal could receive these SMS messages by means of a voice message [19].

Drawbacks on this type of service are therefore that 1) a special telephone terminal is needed in order to send SMS's and the user is restricted to the location of the terminal to send and receive the SMS's; 2) An SMS can only be received when the user is subscribed to a CLI service with associated cost implications; 3) Although the message might be delivered to the terminal instantly, the deaf sender will not be guaranteed that the receiver has actually received his /her message or that s/he will receive the message on time; 4) Although the sMessage terminal is cheaper than a TTY, this telecommunication type is not synchronous like the TTY or the telephone.

South African sMessage service uptake rose briefly (on average eleven sMessage terminals were distributed per month for the period July-September 2008), but only because the service provider gave away free sMessage terminals with CLI service subscriptions. The product will be discontinued in South Africa due to limited product uptake.

2.3 Mobile SMS

Power and Power [7] enthusiastically envisaged that SMS usage in Australia and elsewhere would level the playing field for deaf and hearing individuals.

Similar to hearing individuals, deaf people use SMS's for personal and business purposes. Many organizations around the world accommodate the Deaf and benefit from reaching the Deaf by creating dedicated SMS-lines. The Deaf in Western Australia is for example able to contact the police and a roadside breakdown service, directly via SMS [13].

Advantages of SMS's are speed, cost, ease of use, and the Deaf does not need special equipment to communicate with hearing individuals.

The disadvantages are that as the service is asynchronous; a deaf sender will have no guarantee that the recipient actually read the message, or read it timeously. (Hearing individuals still have the option to follow up by making phone-calls when a message is urgent.)

In brief, the major challenges related to the use of SMS are 1) asynchronicty; 2) no guarantee that a message will be read

timeously; 3) limited options to contact South African companies via SMS.

2.4 Mobile and telephone calls

Before the evolution of the SMS or TTY, Deaf individuals had no choice but to rely on others to make phone calls on their behalf and in doing so they had no privacy.

Deaf people who are not able to recognize voices, or those who are dependant on lip-reading, are not able to use this communication type at all.

Hard-of-hearing individuals might be able to communicate using a phone, but there are several factors that impact the success of the communication. The hard-of-hearing individual's main problem is vowel and/or consonant confusion. [7]. Based on personal experience of the lead author, we argue that the degree of hearing loss, background noise, clarity and quality of the sound, familiarly of the speaker's voice, accent, emotional state, language and speaking tempo are some of the factors that impact a hard-of-hearing individual's ability to communicate using a phone. More detail on this will be discussed later on in the section on survey results and respondent feedback.

2.5 E-mail

For the Deaf, *"…e-mail is the most common method used for business/work and for contacting services…"* [14]. E-Mail has the advantages that attachments and unlimited text length are possible [12]. Users are still constrained due to the asynchronous nature of the communication process. Read receipts are possible with email, though not reliable as the recipient can opt out of sending a read receipt.

2.6 Fax

The fax machine is still widely used (but not as the preferred means of communication) by deaf individuals, despite the fact that the technology is asynchronous, unsuitable for emergency communications and prone to occasional transmission difficulties [12]. "Fax machines are used for instrumental and informational purposes in that Deaf organisations use them to broadcast information to their members" [14].

Advantages of this telecommunication method are its speed and the ability of the sender to keep a hard copy of what was sent.

2.7 Instant Messaging (IM)

IM had a mobility drawback in that it was only accessible from a computer, but since the recent release of mobile phones with multimedia capabilities, IM has become wireless and can now be accessed from PDA's, cell phones and pagers.

Many deaf individuals avoid social interaction because "[t]hey are worried about mishearing people and therefore misinterpreting what is being said to them" [2]. Due mainly to the synchronous nature of IM communications deaf users experience a sense of independence as "physical proximity disability and time are no longer factors". [2]. IM can thus increase social interaction opportunities for the Deaf.

Drawbacks of this communication method are that it inadequately conveys emotions (only through emoticons), voice tone and facial expressions (except when combined with a webcam) and because of the anonymity, people tend to become less uninhibited and can display aggressive or disrespectful behaviour.

Despite its impersonal nature IM is a popular choice of communication among the deaf because "embarrassing mistakes due to mishearing" are eliminated and factual information can be transmitted accurately [2].

Availability of businesses via IM holds much promise, provided that deaf individuals have adequate access to the service and that businesses will respond to messages sent through this service.

3. RESEARCH DESIGN AND METHODOLOGY

3.1 Role of the Researcher

The lead author is hearing impaired. This may have both advantages and disadvantages in terms of the research results. Advantages might be that the respondents put effort into answering open-ended questions, because they might have felt that the author will understand them better than a hearing individual. Also, previous experience with deaf individuals became helpful when the author compiled the questionnaire, as the author knew how to communicate with the Deaf and to predict their behaviour and their understanding of the questions when they complete the questionnaires. The disadvantage might be that the author's own feelings and ideas about the Deaf telecommunication situation in South Africa will have shaped the direction of the research; however conclusions and discussions in this paper are related directly to responses to the survey.

3.2 Research Approach

Although the survey produced some descriptive statistics, the main focus was to understand social issues in Deaf telecommunications usage. The social information was obtained through open-ended questions or follow-up interviews with respondents.

The author sent invitation letters via e-mail to participate in the survey, to two organisations for deaf people, DeafSA and National Institute for Deaf. The author also posted the invitation on online Deaf community forums and groups. Upon request, the questionnaire was sent out (in Afrikaans and English) via e-mail.

As the authors did not know the language proficiency of respondents, special care was taken when conducting interviews or questionnaires, to eliminate ambiguity in order to cater for the possibility that some of the respondents may have limited vocabulary [11]. To ease understanding the questionnaire was made available in more than one language in order that the Deaf could choose the language they are most fluent in. Examples on how to complete questions were provided, as they might be inexperienced in the process of completing questionnaires.

The questionnaire consisted of questions relating to usage trends of telecommunication products, when those products are used and for what purpose. Space was provided for comments by the respondent.

A total of 45 questionnaires were sent out and 20 replies were received. Although the research sample is small, it is acceptable for the purpose of our limited qualitative and exploratory study. We recommend further research that would investigate the specific issues and trends in more detail – some of the potential avenues for further research are detailed in the conclusions section of this paper.

3.3 Limitations of this study

All questionnaires were sent out and received in electronic format (e-mail). We could therefore assume that all respondents have occasional access to the internet and are relatively comfortable with IT. The results of this research are thus not a

valid representation of Deaf telecommunication in all sectors of South African society, but rather a limited representation of Deaf telecommunication in technologically advanced sectors of the population who can speak either English or Afrikaans and is related to an organisation for the Deaf (DeafSA and the National Institute for the Deaf). The percentage of the population whose first language is Afrikaans or English is approximately 21,5% [18]. The World Bank estimate on the number of Internet users in South Africa is 8.6 users per 100 people (2008 data) [20].

As previously mentioned the fact that the lead author has a hearing impairment means that the paper has been written from a particular perspective which influences the focus of the study and the interpretation of the findings.

Nevertheless, although the authors recognize the limited scope and exploratory nature of the paper, the ultimate purpose of the paper is to highlight the scarcity of studies related to Deaf telecommunications in South Africa, to illustrate the need for research in this area and to stimulate debate related to the issues that have been highlighted in the findings.

4. RESEARCH FINDINGS

The findings have been structured into sub-sections: (1) A description of background demographics; (2) Overall telecommunications usage by respondents; (3) Access to services in South Africa and associated challenges; (4) Employment and associated challenges.

4.1 Background demographics

Slightly more males than females were involved in the survey, with a male response rate of 55% and a female response rate of 45%.

General Demographics: 60% of the respondents were over thirty years old, and 40% were between nineteen and twenty-nine years old. The impact of age on this study might be that the older respondents may not use the newer technologies (IRC versus TTY) and the younger respondents might not use the older communication technologies.

All of the respondents have completed school, with 30% of the respondents having taken up further studies. 10% have studied further towards a diploma and 20% have studied further towards a degree.

All respondents were employed at the time of the survey and form part of the South-African workforce. We assumed for the purpose of this investigation that they would therefore need access to government services and to interact with government in various ways. Unencumbered access and interaction for the Deaf constitutes a fundamental right and we therefore explored the current status of accessibility of government services as part of this study.

Degree of hearing loss: The categories for this question were based on a communication scenario: If the respondent were fitted with hearing aids and another person would approach him/her from behind and talk slowly and clearly (note that lip-reading is not possible) would the respondent be able to hear and understand what the person has said?

Table 1: Summary of respondents' degree of hearing loss

Category	% of respondents
Completely deaf even with the assistance of hearing-aids.	0
Able to hear sounds with the hearing aids, but unable to recognize the words at all, no matter how clearly the person speaks.	35%
Able to hear and understand the person, but only if the environment is very quiet and there are no interfering background noises	25%
Able to hear and understand the person, even when there are interfering background noises	25%
Hearing 100% when fitted with hearing aids, and lip-reading and eliminating of background noises are not issues at all	15%

All respondents indicated that they are able to hear sounds with assistance of hearing aids. But hearing sounds, does not necessary enable them the understand speech, as they might not be able to hear all sounds. 60% of them fall in the severe to profound deaf category, which means even with the assistance of hearing aids, they have trouble communicating without visual signs (lip-reading and sign language).

Communication Preference: Two communication possibilities (speak and sign) and a combination of speak and sign were used to differentiate this communication preference item.

Table 2: Communication Preferences of respondents

Category	Response
Using a different communication method than to speak or to sign	0%
Prefer to communicate using sign-language only	5%
Either speak or sign, sometimes doing both at the same time.	50%
Prefer to "speak" when communicating with deaf or hearing individuals. Even when they cannot hear what is being said, they make use of lip-reading to follow conversations.	45%

4.2 Overall Telecommunication product usage by the Deaf

The respondents were questioned on the various products that are available for the Deaf to communicate, and the products that they are actually using. Respondents were allowed to choose more than one product. A summary of these findings is graphically shown in Figure 1.

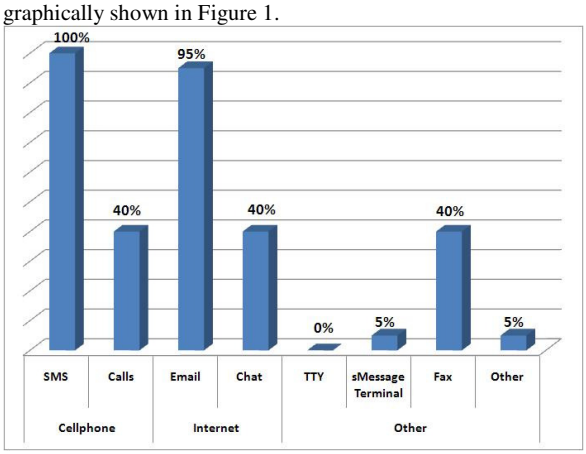

Figure 1 Graphical summary of products available for the Deaf and actual usage

Note that the Deaf's ability to make calls using a cellphone does not necessarily enable efficient and effective use of this telecommunication method. As one respondent stated, *"I can't really hear on the phone, but I use it when there is too much to*

say for an SMS and I need a quick answer. E.g. I will call my mom and when I think we're connected I will start talking and tell her my story without really knowing if she's following. Then I will hang-up and she will SMS me back with her answer."

We believe that understanding in the process of communication is even more important than simply being getting hold of the communication partner. In Table 3, the communication types have been arranged from highest understanding to lowest and then from highest rate of getting hold of someone, to the lowest. These values were derived from the survey data.

For communication with friends and family both the chat programs method and the sMessage terminal received the highest scores for both understanding and rate of getting hold of someone (Always/Always).

For communication with businesses, chat programs method again received the highest scores in terms of understanding and getting hold of someone. However, the usage percentage is very low (10%).

Table 3: Product usage summarized in terms of connectivity and understanding

Communicating with Friends or Family				
	Getting hold on time?	Under-standing	Usage %	How Often
Chat programs	Always	Always	40%	Weekly
sMessage Terminal	Always	Always	5%	Weekly
Mobile phone (SMS)	Sometimes	Always	100%	Daily
Fax	Sometimes	Always	25%	Monthly
E-mail	Sometimes	Always	100%	Daily
Mobile phone (Calls)	Always	Sometimes	40%	Daily

Business communications				
	Getting hold on time?	Under-standing	Usage %	How Often
Chat programs	Always	Always	10%	Monthly
Fax	Sometimes	Always/Sometimes	30%	Monthly
Mobile phone (Calls)	Always	Sometimes	35%	Weekly
Mobile phone (SMS)	Always/Sometimes	Sometimes	25%	Monthly
E-mail	Sometimes	Sometimes	80%	Monthly

E-mail, which had the highest usage rate (80%), was rated least successful by the respondents for business communications. The reason for the high usage of the email communication method could be related to the fact that most businesses only provide e-mail addresses and telephone numbers on their contact page, and do not make use of the other communication types (which the Deaf would prefer).

4.3 Accessibility of South African services and associated challenges

Respondents were probed on their views related to general accessibility of services in South Africa.

Since all respondents were employed and older than eighteen years, the author has assumed that all respondents have social responsibilities and have a need to be able to contact service providers in South Africa to make a living.

The example scenario to illustrate the question was: Would the respondent be able to rectify a problem with an electricity bill by contacting the applicable service provider using his/her available means of telecommunication? (The use of a mediator to assist with e.g. phone calls and visiting the business for a face-to-face meeting were explicitly excluded for the purpose of this question.)

Only 25% of the respondents believe that they will be able to rectify the electricity bill problem on their own, so it is fair to say that 25% of the respondents believe they have a fair chance to access South African services. However 75% of the respondents indicated that South African services were not accessible enough for the Deaf and that they will not be able to rectify the problem without asking someone else for assistance or without taking effort to go to see the business face-to-face.

The respondents stated that they do not have the easy access to services that hearing individuals would have. *"We can't just pick up the phone and call to get something done. If an e-mail address is available and you e-mail them, it sometimes takes ages before you get a reply; that is if you get a reply!"* Sometimes they have no choice but to go the business or shop to sort things out.

Toll-free numbers are not accessible for the Deaf and when they ask someone to call on their behalf, the business sometimes still insist to speak to the Deaf person, *"it is like they do not understand that "being deaf" means you cannot hear them. Why will I ask someone else to call on my behalf if I can speak to them myself?"*

The hard of hearing individuals who are able to make phone-calls (with effort), complained that computer operated voice prompts are only available in one language, fast and inaudible with no option to prompt immediate repeats without having to start all over again and when they still cannot hear what is being said, there is no human available to repeat or spell things out. Many of the Afrikaans-speaking hard-of-hearing individuals complained that English is a very difficult language to hear, because of the softer sounds.

When making a call to a call-center, the hard-of-hearing individuals argued that human operators are not trained to talk to hard-of-hearing people; they shout, talk fast and get impatient when they struggle to understand them or when they ask them to repeat certain words.

These examples explain why the Deaf would rather ask a mediator to call on their behalf, but this means having to share personal information with other people which is uncomfortable.

Some of the respondents stated that they are purposefully avoiding telecommunications because of poor infrastructure, support, lack of knowledge and lack of awareness of deafness. *"I would rather keep bugging someone else to make calls on my behalf. Yes, it is annoying, because you have to keep following up and reminding them to do it, but when doing it myself; it takes much longer to enquire about something or to inform somebody of something."*

60% of the respondents indicated that they have been in situations that they had no choice but to share private information with a mediator. This creates another dilemma. *"It's really embarrassing…"* one respondent stated,

"…sometimes you're at work and have no choice but to ask a colleague to make a call on your behalf. And I don't want my colleague to know that I'm making an appointment with a debt counselor!" 40% of the respondents indicated that they address this issue through using trusted people e.g. spouses, family or partners.

Is it currently easier for the Deaf to communicate in South Africa than five years ago? 65% of the respondents agreed that it is nowadays much easier to communicate and 35% of the respondents were of opinion that there is no difference and they still struggle to communicate.

'Awareness' is a concept that was frequently mentioned. The respondents want people to have a greater awareness of this disability and that call-center agents should be trained to handle communication situations with hearing impaired clients, being confident and aware of how to talk to them. There should also be greater awareness amongst companies and individuals on telecommunication products that are deaf-accessible. Respondents would like people and businesses to be available through multiple communication channels, e.g. SMS or self-service websites.

Although not yet possible due to multiple South African accents and languages, respondents would really like a mobile phone that can convert speech to text.

4.4 Employment and its challenges

Many deaf respondents explained that the costs of hearing aids, telecommunication devices and cost video calling are a problem for them, because as they argue, *"It's a vicious circle, I cannot afford the costs to communicate, and I cannot fulfill a proper position with a bigger salary, because I cannot call or communicate properly."* Thus according to the respondents, not being able to communicate properly and being excluded from the telecommunication market in SA, negatively impacts the Deaf's career development paths. One respondent felt that companies should *"foot the bill"* for the costs they have to endure to communicate; saying, *"We can only become more productive."*

The respondents are eager to use new technologies, as one respondent stated, *"Please, please get people to use teleconferencing more often!"* With teleconferencing via webcam or cell phones, the possibility of signing or lip-reading can ease deaf communication. They also want IM to be used more widely in business communication to overcome inaccessibility. *"My work blocks IM because the people mainly use it for leisure reasons, but for me it can mean quicker access to information."* Another one said that it's only fair for companies that offer toll-free numbers, to provide SMS accessible numbers as well.

Some respondents felt that the companies they work for should be more considerate towards them so they can overcome the obstacles and that they should offer to relieve communication costs, as well as making allowances such as a personal assistant which the deaf person can ask to make calls on their behalf.

5. CONCLUSIONS

Research was done to investigate telecommunication usage among deaf individuals. The research findings show that Instant Messaging was perceived to be the most successful tool for both business and personal telecommunications, e-mail was most frequently used for business communication and e-mail and SMS were most frequently used for personal communications. Drawbacks for each communication type were pointed out and understanding and getting hold of people are the biggest challenges. Respondents indicated that video-calling (Mobile phones or webcams) should be used more, enabling signing and lip-reading.

Findings show a need by the Deaf for society to be more aware and knowledgeable about deafness and Deaf telecommunications issues.

Ultimately the results of the study indicate that telecommunication devices available for the Deaf are not as beneficial as initially intended and that social factors, notably social ignorance, are the biggest reasons for failure.

Although the findings indicate that the current situation for Deaf telecommunications in South Africa is problematic, various lessons could be learnt from other parts of the world. The authors would recommend a combination of approaches, which could include (1) investigating the possibilities offered by newly developed services and technologies that are available internationally; (2) lobbying government to ensure that policies and regulations enforcing standards of Deaf telecommunications are in line with international best practice to enforce equal access and social inclusion [8]; (3) Fostering strengthening of social networks and collaborative social practices amongst the Deaf [14] and (4) Ensuring that there is a meaningful research agenda on telecommunications for the Deaf (e.g. [8]) and that this research agenda is actively supported by all academic role players.

Some of the newly developed technologies and services that seem promising relate to the provision of relay services [1]. These include Telecommunications Relay Service (TRS) [21] which is available everywhere in the USA and entails operators acting as intermediaries between callers; other relay technologies and services are Video Relay Service (VRS) and Video Telephony [10]. These services are now also being extended to mobile platforms, e.g. MobileASL [3]. Another interesting development is the virtualization of existing devices, e.g. the creation of a 'software TTY' that could be used with a mobile phone – this for example enables US citizens to access existing TTY-based emergency systems from their mobile phones [22]. In spite of the advantages that these developments offer, Power et al. [8] warn that there is always a possibility that an innovative product or service could be experienced by the Deaf as disruptive. This implies that changes related to the improvement of assistive technologies need to be managed well.

Research issues at international level (that would also be of interest to South Africa) include investigating the possibilities offered by visual language based interfaces [6], better awareness and understanding of the concept of accessibility by policy makers and finding innovative approaches to formulating telecommunications policies that promote accessibility (Jaeger, 2006), and understanding the way in which the availability of new technologies is changing the communication behaviour of the Deaf [10].

The authors would also suggest research on the following issues that are of specific interest to South Africa: (1) More extensive quantitative surveys that would be representative of the larger Deaf population in South Africa; (2) In-depth comparison of the results of such surveys with international trends; (3) Examining issues related to those among the Deaf with poor language skills; (4) Launching of action research or design research projects aimed at improving the situation by addressing the various issues highlighted by this research and follow-up surveys; and (5) Examining the implications of culture and language diversity in South Africa on Deaf telecommunications processes .

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