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Barriers for telecommunication accessibility and needs assessment of video relay services (VRS): Utilization of VRS for the deaf community

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Barriers for Telecommunication Accessibility and Needs Assessment of Video Relay Services (VRS): Utilization of VRS for the Deaf Community

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Abstract:

Approximately 28 million deaf and hard-of-hearing people reside in the United States, and a majority of them benefit from Telecommunications Relay Services which is mandated by Title IV of the Americans with Disabilities Act (ADA). Title IV of ADA was drafted based on the provision for TTY services. As Video Relay Services emerged in 2002, it surpassed TTY relay services because of its efficiency compared to the traditional TTY relay.

However, Video Relay Services is a relatively new relay format, and no legal mandates for VRS technologies have been established. Thus, there is a strong need for a better understanding of how VRS are utilized for further policy development.

A survey study was conducted among all deaf and hard-of-hearing professionals employed at Rochester Institute of Technology (RIT)'s National Technical Institute for the Deaf (NTID) in Rochester, New York. Comparative quantitative analysis of whether deaf and hard-of-hearing people are satisfied with either text-based relay services or video relay services to answer the primary research question of this thesis: does VRS provide functionally equivalent telephone access for the deaf?

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1.0 Introduction

Since the telephone was invented in the late nineteenth century, millions of hearing Americans have benefited from this communication device. On the other hand, millions of deaf and hard-of-hearing Americans lacked means for accessing the telephone for the decade. To access this medium, deaf and hard of hearing individuals had to rely on the assistance of hearing family members and neighbors in case of emergencies. The confidentiality of the calls was sacrificed especially if they were made for sensitive topics such as medical or financial conditions (Strauss, 2006).

The concept of telecommunications for the Deaf became reality in 1964 when Robert Weitbrecht invented an acoustic coupler that allowed deaf and hard of hearing people to communicate over the Public Switched Telephone Network (PSTN) using the old teletypewriters (TTYs)--- used equipment disposed of by AT&T, Western Union, and the US military (Lang, 2000). By the end of the 1960s and 1970s, the number of deaf and hard of hearing individuals who owned TTYs increased even though they were not affordable for many deaf and hard of hearing Americans. They were desperate for direct telecommunication access without sacrificing their independence and self-sufficiency. Still, they had no means of reaching out to other hearing callers.

During the 1970s and 1980s, several organizations across the country began providing relay services on a voluntary basis for those who were using earlier model TTYs; however, significant limitations existed. Oftentimes, earlier state-run relay services provided services within very limited hours during the day, and the numbers of calls per day were also restricted (Strauss, 2006). These limitations were frustrating deaf

and hard of hearing especially when they were placed on hold while they were calling governmental agencies. They were frequently disconnected in the middle of the calls.

In the cultural context of the United States, the concept of independence and self-sufficiency to control one's life played pivotal roles regarding the rights of individuals with disabilities (Middleton, Rollins & Harley, 1999). Telecommunications relay services were no exceptions, and deaf and hard-of-hearing people demanded rights for telecommunications access to mainstream society as part of their civil rights. Due to an enormous lobbying and advocacy effort, the Title IV of Americans with Disabilities Act (ADA) of 1990 finally mandated telecommunication accessibility for those who are deaf or hard-of-hearing, and persons with speech disabilities.

Today, Telecommunications Relay Service (TRS) is known as telephone services that provide access for individuals with hearing or speech disabilities to place and receive telephone calls. TRS is available anywhere in the United States, 24 hours a day, 7 days a week. Telephone relay services require operators to assist telephone conversations between hearing callers and deaf or hard-of-hearing callers.

Title IV of ADA mandates "functionally equivalent" access for telecommunications and mandates that the FCC initiate and regulate TRS. The FCC (2006) defines "functionally equivalent" access as providing the same level and quality of access to telecommunications for deaf and hard-of-hearing individuals as is available to all other Americans. For example, hearing callers expect and receive dial tone instantly when they pick up a telephone to place a call. The ADA mandates that deaf and hard-of-hearing individuals should enjoy the same privilege. In order to achieve functional equivalence, Title IV of the ADA added Section 225 to the Communication Act of 1943.

Section 225 contains the TRS mandatory minimum standards so that TRS users have the same privilege to access the telephone system as do hearing callers.

Technology has significantly improved since 1990. TTYs were the only medium of telecommunications available for the Deaf to access TRS when the ADA was written in 1990. However, text-based relay services were not most effective for deaf and hard of hearing people because of technical limitations and linguistic barriers as English was not a primary language of communication for many deaf and hard-of-hearing individuals. Therefore, several pioneers such as Ed Bosson, Benjamin Soukup, and Gil Becker, began exploring new technologies for relay services using American Sign Language as their mode of communication (Strauss, 2006). The concept of Video Relay Services (VRS) was born, and experiments began in several states. Soon, VRS proved a significant improvement over text-based relay services for those who used American Sign Language (ASL) as their primary or preferred language of communication.

While VRS has rapidly expanded since January 2002, it is still a relatively new telecommunications relay format that has yet to be recognized by federal laws (i.e. under Title IV of the ADA and Section 225 to the Communication Act). Consequently, there is no legal mandate for VRS technology to be provided in public facilities (e.g. airports, libraries, hospitals, etc.), as is the case with TTY devices. While the TTY brought improved access to telecommunications services for deaf and hard of hearing people, the advancement in technology with VRS offers the possibility that the gap in functional equivalence be closed even further.

This thesis explores how Video Relay Services (VRS) are utilized among deaf and hard-of-hearing professionals at the National Technical Institute for the Deaf and

other units of Rochester Institute of Technology. In addition, the thesis will provide an overview of barriers that deaf and hard of hearing professionals face with the current telecommunications relay services, and whether Video Relay Services enhances access to existing telecommunications services to answer a primary research question: Does VRS provide functionally equivalent telephone access for the deaf?

2.0 Literature Review

In order to understand what brought telecommunications relay services (TRS) into reality for deaf and heard of hearing people in the United States, it is essential to understand the following: how federal disability policy has evolved, how telecommunications became available for the deaf, and the current state of technologies available for the deaf. This section aims to provide a comprehensive review of literature regarding the three primary focuses above.

2.1 Disability Policy Framework in the United States

First, there is no universal definition of "disability." No single accepted definitions regarding disability exists today because the term "disability" has been subject to many different definitions, in various disciplines, for different purposes. Mitra (2006) argues that the differences in definitions are derived from various theoretical models of disability. Still, each model still has crucial implications on social, economic, and political developments regarding people with disabilities.

2.1.1 Theoretical models of disability

Kaplan (2007) presents an overview of four major models of disability, which are acknowledged by a wide range of disability policy scholars. The first model is a **moral**

model of disability. This is the oldest model and it is less prevalent in today's society. This perspective regards disability as the result of sin or karma within families. Many cultures still associate disabilities with sin and shame, so that many families exclude their family members with disabilities from formal schooling and any meaningful roles to participate in society.

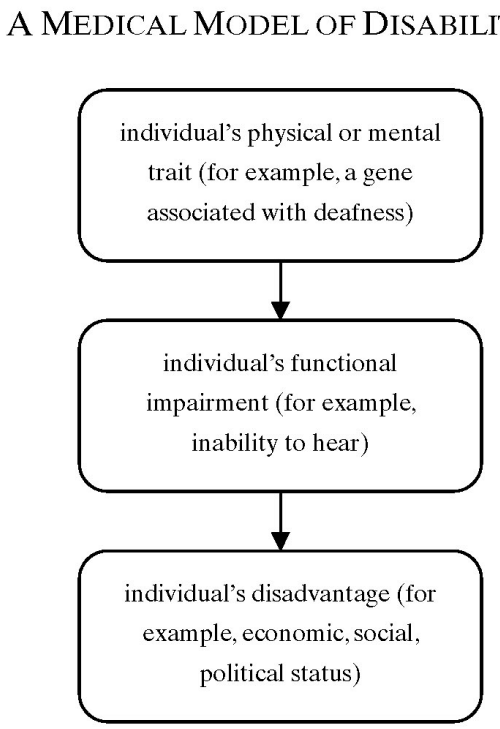

Figure 2.1. Medical Model of Disability (Source: Samaha, 2007).

The second model, a **medical model**, perceives disability as a defect or sickness, which must be treated by medical or other professionals. Under this model, disability is regarded as a health issue, to be cured or compensated by society. This model primarily focuses on the disadvantages caused by physical or mental impairments rather than the environment (Samaha, 2007). Ingram (2006) notes that the medical definition of disability reflects a welfare paradigm of disability policy today, which often assigns a persistent "sick" role to individuals with disabilities.

The third model, a **rehabilitation model**, regards disability as a deficiency that must be treated by rehabilitation experts. Through vigorous trainings or vocational rehabilitation programs, people with disabilities become "normal." Legislation regarding Vocational Rehabilitation was established based on a rehabilitation model (Scotch, 2001).

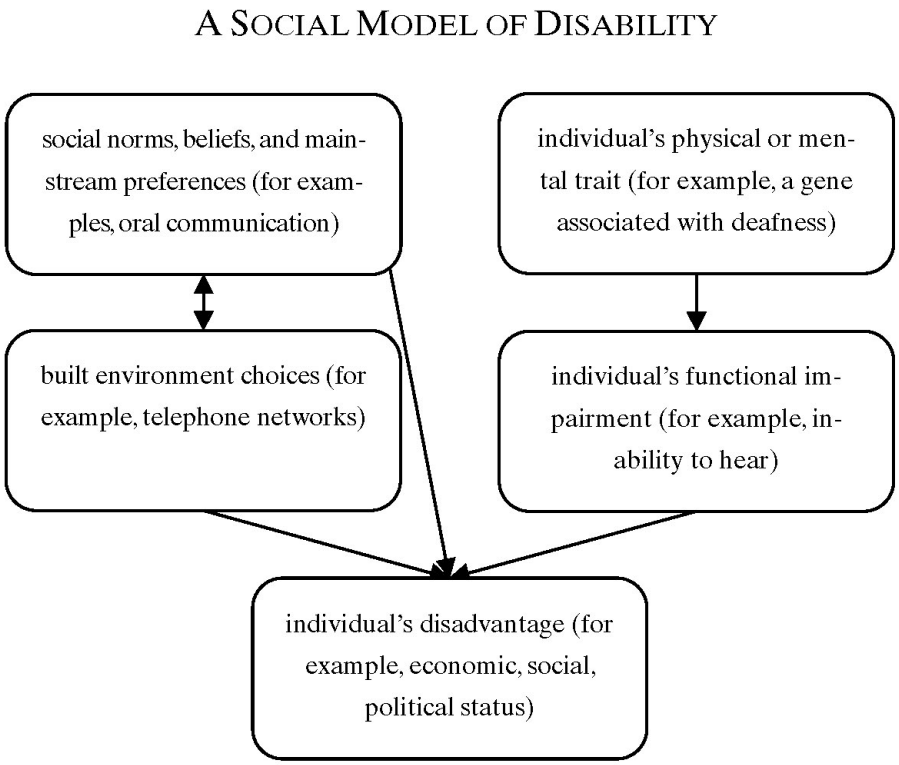

Figure 2.2. Social Model of Disability (Source: Samaha, 2007).

The fourth model, a **social model**, stands in contrast to the three models indicated above. The social model views disability as a social construct, a normal aspect of life, not as a defect or sickness. Disability is not an attribute of the individuals; but rather, the social environment creates the disability. Thus, it requires a social change. Fundamentally, the government or society should accommodate individuals with disabilities to achieve full inclusion or integration under this model. This model gained popularity during the

1970s and 1980s in the United States along with the evolution of the Civil Rights movements (Scotch, 2001).

The World Health Organization (WHO) developed the International Classification of Impairments, Disabilities, and Handicaps (ICIDH) in the early 1980s by following the traditional models of disability (Hurst, 2003). It received a lot of criticism from the disability community because it adopted the medical model. The ICIDH was recently revised and renamed as the International Classification of Functioning, Disability, and Health (ICF) which provides a coherent view of a combination of both medical and social model of disability.

2.1.2 Transformation of federal disability policies

In the 1960s, a fundamental transformation occurred in federal disability policy. A series of public laws regarding civil rights for persons with disabilities such as the Architectural Barriers Act of 1968, the Rehabilitation Act of 1973, and the Education for All Handicapped Children Act of 1973 were passed in Congress (Percy, 1989). Section 504 of the Rehabilitation Act, passed in 1973, prohibited discrimination by entities that receive federal funds against people with disabilities in a range of areas, such as employment, social services and education. The Americans with Disabilities Act (ADA) also maintains the same stance as Section 504 of the Rehabilitation Act following the Civil Rights approach regarding the rights of individuals with disabilities (Scotch, 2001). The ADA defines an individual with disability as "someone with a physical or mental impairment that substantially limits that person in some major life activity, someone with a record of such a physical or mental impairment or someone who is regarded as having such impairment" (The Americans with Disabilities Act of 1990).

Ingram (2006) argues that the ADA confuses people with two different paradigms: a civil rights paradigm that guarantees equal treatment as first-class citizens, and a welfare paradigm that demands reasonable accommodations with those who require special needs. In addition, Stein (2006) argues that a current disability rights paradigm lacks protection for ensuring human rights for people with disabilities. Thus, he proposes a "disability human rights paradigm" that invokes both civil and political rights as well as economic, social, and cultural rights. However, Schriner and Scotch (2003) insist that the ADA still represents the culmination, and symbolic victory, in federal disability policy of the past two decades.

2.1.3 Deafness and disability

Today, people with disabilities often claim participation on the basis of rights rather than on the basis of good will and charity of philanthropists, the government, or the general public. Deafness is often regarded as a disability by "hearing society". For legislative and social policy purposes, deaf people are still categorized as disabled, although there is considerable disagreement within the deaf community on whether or not deafness should be regarded as a disability (Lane, 1995, Harris & Bamford, 2001). Lane (1995) proposes that the deaf population form a cultural construction that shares more common features with minority ethnic groups than with other disability groups because they use their own unique language, American Sign Language (ASL). Baynton (1996) also adds "Deafness is a cultural construction as well as a physical phenomenon (p.2).

However, Corker (1998) argues that this linguistic minority or cultural construction approach would have unsatisfactory consequences on the political level because it creates an artificial division between culturally deaf people and others who do

not associate themselves as linguistic minorities. Creating a division would lead to competition for the same resources, ultimately confusing policymakers in determining which group of deaf people has the greatest need.

The paradigm shift in disability policy impacts how policymakers define "disability" and how they respond to the societal barriers imposed on people with disabilities. Under the latest framework of disability, the social model, deaf people are handicapped by those who do not use sign language, rather than through a fault of their own inability to speak. Many deaf individuals started recognizing themselves as a cultural or linguistic minority, and excluding themselves from people with other types of disabilities, even though it might be politically ineffective to do so. Sign language interpreters are provided to facilitate communications and cultural exchanges between hearing and deaf people. Telecommunications have been inaccessible for most deaf and hard-of-hearing individuals and have presented significant societal barriers for many people with disabilities. Thus, deaf and hard of hearing people as well as other disability advocates demanded that telecommunications be made accessible by providing telecommunications relay services.

2.2 Telecommunications for the Deaf

In this section, the following items will be discussed: an overview of the deaf and hard-of-hearing population, universal mandates of the Communication Act of 1934, the early breakthrough of telecommunications for the deaf prior to the passage of the Americans with Disabilities Act (ADA) in 1990, the Telecommunications Act of 1996, and finally the emergence of Video Relay Services (VRS). The section aims to provide an overview of legislative and regulatory background of Telecommunications Relay

Services (TRS) as well as technological developments that led to the establishment and growth of telecommunication relay services for deaf and hard-of-hearing people in the United States.

2.2.1 Deaf population

In the United States, 51.2 million people (18.1 percent of the general population) have some level of disability, and 32.5 million people (11.5 percent of the population) have a severe disability (U.S. Census Bureau, 2006). Among these, approximately 28 million of them are deaf or hard-of-hearing (SHHH, 1996). According to the Gallaudet Research Institute (2005), those estimates are typically based on one of two national household surveys conducted by the federal government: the National Health Interview Survey (NHIS) or the Survey of Income and Program Participation (SIPP). GRI also points out that there is no single consensus on the estimates because of the various definitions of deafness used by different federal agencies. However, the available statistics are beneficial for policy makers to understand how many constituents require services such as telecommunications relay services (TRS).

2.2.2 Universal mandates

In 1934, Congress enacted the Communications Act. The Act opens by declaring its intent (Bowe, 1993):

"For the purpose of regulating interstate and foreign commerce in communication by wire and radio so as to make available, so far as possible, to all the people of the United States a rapid, efficient, Nation-wide, and world-wide wire and radio communication service with adequate facilities at reasonable charges …" (p.765).

Bowe (1993) points out that the term "universal" seldom included persons with disabilities in 1934. The Communications Act of 1934 has contributed to the development of the telecommunications industry in the United States, and nearly every household in the United States is equipped with the telephone. However, Bowe (2005) also emphasizes that many generations of deaf Americans have lived and died without ever making a phone call on their own. Lang (2000) also confirms that there were more than 85 million telephones in the United States and Canada by 1964; however, at that time no more than one percent of the nation's deaf people used telephone independently on a regular basis.

2.2.3. Early breakthrough

Prior to the 1960s, Western Union, United Press International (UPI), American Telegraph and Telephone (AT&T), and other telecommunication companies and news service typically used devices called *Teletypewriters* to exchange text communications. This device relied on technology called "5 level Baudot," a format for data transmissions that had existed since the invention of the telephone itself. Due to the technical limitations, Baudot was not able to keep up with the computing needs of the 1960s. Thus, obsolete teletypewriters were replaced with more reliable technologies that adopted "8 level ASCII" (Strauss, 2006).

In 1964, Robert H. Weitbrecht, a deaf scientist, invented an acoustic coupler that enabled deaf people to use teletypewriters via the Public Switched Telephone Network (PSTN) (Lang, 2000). His invention was a great breakthrough for millions of deaf and hard of hearing people because they were now able to communicate independently with

their deaf friends. As the number of the deaf TTY owners increase, they demanded that public facilities install TTYs.

In 1973, Congress enacted Section 504 of the Rehabilitation Act, which prohibited programs and activities receiving federal funds from discriminating on the basis of disability. Even though the law did not take effect until 1977, the law provided new rights for the deaf to request the installation of TTYs in Social Security offices, hospitals that receive Medicare and Medicaid, and universities that provided federal financial aid. In addition, local law enforcement agencies that received federal funds were required to provide TTY access (Strauss, 2006).

However, there were still no means for deaf and hard of hearing individuals to communicate with hearing people. Thus, the concept of telecommunications relay services (TRS) using the TTY was born. Bahr (1992) illustrates TRS in a detailed example: "Suppose a person who can speak and hear well enough to make standard use of a telephone (a "voice telephone user") wants to call a deaf person who has a TTY. The voice telephone user would call a communications assistant (CA) who would have a TTY available. The CA would use the TTY to call the telephone number of the TTY user. The CA would then transliterate messages from the voice telephone user to the TTY user and vice versa" (p.2). As the number of deaf individuals owning TTYs grew, some organizations began providing relay services in the early 1970s through the 1980s on a voluntary basis (Lang, 2000). However, there were various restrictions, and deaf people were frustrated with the inadequate quality of services. Rosen (2007) recalls his frustration with the earlier relay services as follows: "Adding injury to insult were the limitations on the charity-based relay service, including up to only three calls a time, with

busy numbers being counted and queues that often stretched in the good part of the hour before having access to the next available individual to relay my call" (p.14).

Advocates for relay services fought tirelessly to demand nationwide relay services available for those who are unable to access to telecommunications. In March 1988, a powerful revolution, the Deaf President Now (DPN) movement, began at Gallaudet University, and it caught national and international attention. Switzer (2003) acknowledges the significance of DPN in American disability policy because of the enormous amount of media attention, and it contributed to the passage of the ADA. In October 1988, President Ronald Reagan signed the Telecommunications Accessibility Enhancement Act (TAEA) of 1988. The Act established a federal relay service for calls to, from, and within the federal government. The passage of TAEA ignited an engine that lead to nationwide relay services (Lang, 2000).

2.2.4 ADA and Telecommunications Act of 1996

On July 26, 1990, The Americans with Disabilities Act (ADA) was signed into law. Title IV of the ADA mandates that the FCC be in charge of regulating relay services and mandates telecommunication carriers to provide nationwide relay services 24 hours a day 365 days a year without restrictions. In addition, Title I of the ADA requires private employers (with 15 or more employees) to provide reasonable accommodations, including TTY access for the deaf. Title II covers state and local government, and Title III covers places of public accommodation (Strauss, 2006). The relay mandates of ADA only covered basic telecommunications services. Voicemails and automated voice massages (or interactive voice response, IVR) fall into the category of information

services, and information services were not covered under the ADA (National Association of the Deaf, 2000).

During the 1990s, revolutionary advancement in telecommunications occurred. More people began to frequently use voicemail and automated voice messages, especially at governmental agencies, businesses, and schools. However, these information services were not mandated under the provisions of the ADA. Thus, Telecommunications Act of 1996 included these two within its scope by adding Section 255. Section 255 mandates that telecommunication manufacturers and service providers make their equipment and services accessible if they are "readily achievable" (Strauss, 2006). According to the FCC (2008), "the 'readily achievable' standards require companies to incorporate access features that are easily accomplishable without much difficulty or expense" (p. 3). This concept of "readily achievable" provided telecommunication manufacturers and service providers with some flexibility, and the FCC determines compliance on a case-by-case basis. Kanayama (2003) took the interest group approach to analyze the FCC's statutory position, and she strongly suggested that this pro-industry approach would just maintain the status quo of the voluntary efforts in the industry, and that people with disabilities would not be able to benefit.

2.2.5 Emergence of Video Relay Services

Even though TTY-based telecommunications relay services opened doors for many deaf and hard of hearing individuals and allowed them to enjoy social and economic benefits that had been lacking due to communication barriers, there was still an enormous disparity between the typing speed of text relay calls and the speed of sign language interpreting of oral communications (Rosen, 2007). Thus, Ed Bosson, a deaf

relay administrator for Texas, insisted upon and pilot tested a visual communication medium, which was needed for people whose primary language was American Sign Language (ASL). He spent almost a decade convincing governmental authorities to include videophone as part of the relay system.

In 2002, the Federal Communications Commission (FCC) allowed use of the Interstate TRS fund for the provision of Video Relay Services (VRS). As a result, more than a dozen video relay service providers have sprung up to provide VRS. Robitaille (2002) points out that VRS is a salvation for those who are deaf and rely on either sign language or lip reading, because VRS interpreters can convey the mood of callers. Robitaille (2002) also suggests that VRS would be an excellent alternative for those who prefer sign to English since it requires no typing. However, Lange (2003) and Bowe (2005) caution that VRS are still not mandatory according to laws such as the ADA and Section 255. In addition, video images can be blurry, jerky, and erratic if consumers do not have access to high-speed Internet connection.

According to the FCC (2006), there were approximately 7,200 monthly minutes of use in January 2002, when the official VRS was launched in the United States. By January 2004, there were nearly 500,000 monthly minutes of use, and the number of VRS minutes surpassed three million in December 2005. As the number of minutes rapidly grew, the number of VRS providers also increased as well to participate in this new industry.

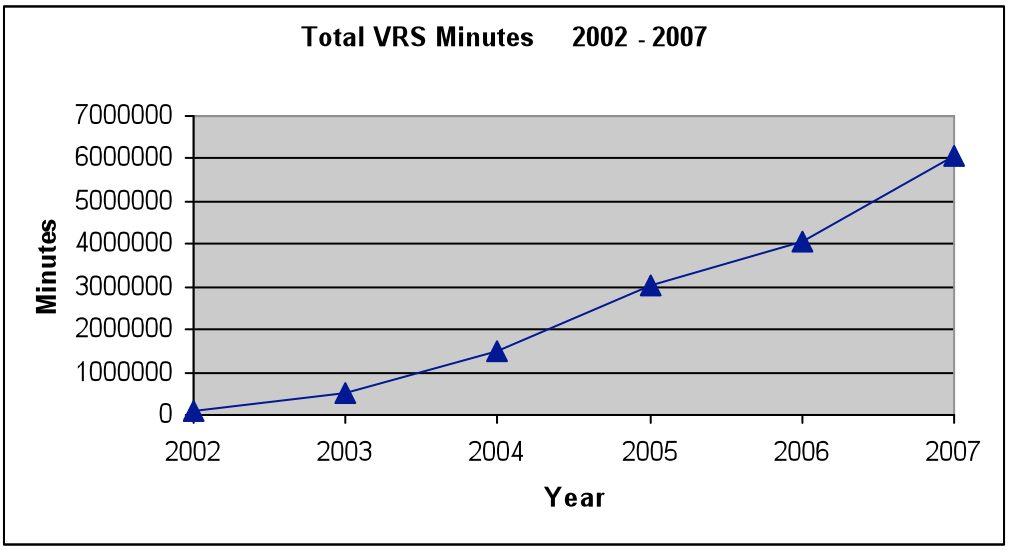

Figure 2.4 VRS Minutes January 2002 – December 2007 (Source: NECA, 2008)

According to the National Exchange Carrier Association (NECA), the total number of VRS calls during the fiscal year of 2005-2006 was approximately 8.5 million, and the total number of minutes for VRS was approximately 35 million (NECA, 2007). The following year, the total number of calls increased to approximately 13 million, and the number of minute increased to 52 million (Figure 2.4). These figures provided by NECA strongly indicate that VRS could dominate as a preferred alternative form of telecommunications relay services for the deaf in the 21st century.

2.3 FCC and Functionally equivalent access

The major achievement in enhancing telecommunications accessibility for the Deaf was Title IV of the Americans with Disabilities Act. Not only did the ADA require all telephone companies to provide both intrastate (within the states) and interstate (across states) relay services throughout the United States, but also required those relay

services to be "functionally equivalent" to voice telephone services (National Association of the Deaf, 2000).

The FCC (2006) defines "functionally equivalent" access as providing the same level and quality of telecommunications access to deaf and hard-of-hearing individuals as to all other Americans. For example, hearing callers expect and receive a dial tone instantly when they pick up a telephone to place a call. In order to achieve functionally equivalent access, Title IV of the ADA added Section 225 to the Communication Act of 1943. Within the Section 225, FCC established the TRS mandatory minimum operational, technical and functional standards (FCC, 2008). The first telecommunications relay services order released by the FCC is read as follows:

First Telecommunications Relay Services Order
July 26, 1991
47. C.F.R. §64.601 et. seq.

- Relay services to operate 24 hours a day, 7 days a week without limits on call length, type, or content
- Relay operators to have competent skills in typing, grammar, spelling, interpretation of typewritten ASL, familiarity with hearing and speech disability cultures, languages and etiquette
- Relay providers to accept single or sequential calls
- Relay operators to not disclose call content, nor keep copies of any relayed conversation
- Relay operators to relay all conversations verbatim
- Relay services to accept either ASCII or Baudot formats
- 85% of all relay calls to be answered within 10 seconds
- Relay users to be given choice of long distance telephone company
- Relay users to pay rates no greater than rates for functionally equivalent voice communication with respect to duration of call, time of day and distance from point of origination to termination

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Source: Chart 6.1, Page 128, Strauss, K. P. (2006)

These "functionally equivalent" standards ensure that deaf and hard-of-hearing callers are able to access the telephone system in the same manner as voice telephone users. Bahr (1992) points out that adoption of these standards would reduce complexity and enhance consistency among various relay services providers, and therefore improve ease of access. Some might argue that government should promote fair market and competition, rather than regulating the telecommunications industry to provide services. However, Percy (1989) insists that this type of regulation –social regulation - is most relevant to advancing civil rights and opportunities for those who are with disabilities.

The former president of the National Association of the Deaf (NAD), Andrew Lange (2003) stressed that the concept of "functional equivalency" is critical for advancing telecommunications access for the deaf. Lange (2003) also notes that the ADA does not clearly specify what "functionally equivalent" access is, and that deaf and hard-of-hearing individuals should go to Congress and urge the FCC to clearly define the term.

According to The U.S. Office of Management and Budget (2007), the FCC occasionally evaluates whether the TRS is providing "functionally equivalent" access to voice telephone service; however, no specific long-term measures have been taken to evaluate it. Even though there is output-related data such as minutes of use, number of service providers and service options, the outcomes and benefits of TRS are still unclear. This finding resonates with Percy (1989)'s claim that federal authorities often lack the capacity for supervision and implementing the program. OMB acknowledges that it is more difficult to measure diffusing societal benefits; however, there should be some measures established to evaluate the program. Also, OMB suggests that the FCC adopt

new mandatory minimum standards regarding new types of services such as 3-way calling and other services (OMB, 2007).

In December 2006, the National Council on Disability (NCD) released a policy paper calling on Congress and the Administration to improve telecommunications and information services for people with disabilities. The NCD stated that current telecommunication relay services including VRS lack a consistent uniform numbering scheme for receiving incoming calls such as the conventional voice telephone numbers associated with the North American Numbering Plan (NCD, 2006). NCD argues that the lack of numbering parity makes it very difficult for hearing callers to reach deaf callers. Currently, several VRS agencies are proposing several initiatives to solve this numbering issue, and FCC might proceed to implement the consistent uniform numbering scheme for deaf and hard of hearing callers (FCC, 2008).

According to NCD (2006), "calls from hearing people to deaf VRS users have hardly risen, and presently account for scarcely 1-2 percent of all VRS minutes" (p. 35). Even if deaf people are able to place a call using telecommunication relay services, it is not "functionally equivalent" to the voice telephone system if they are unable to receive calls. Also, it is not "functionally equivalent" if deaf and hard-of-hearing callers are still unable to access new emerging information such as 3-way calls, recorded messages (IVR), and voicemails as it is mandated by Section 255.

2.4 Rationale for Policy Research

This literature review first explored the disability policy framework in the United States as well as theoretical models of disability in order to understand how federal disability policies have transformed. Then, legislative and regulatory background of relay

services was investigated to understand how telecommunications relay services became reality in the United States. Finally, "functionally equivalent" access was explored consulting literature available at FCC, OMB, NAD, and NCD. Since the primary focus of this thesis is to understand deaf and hard of hearing users' experiences utilizing VRS and text-based relay services, funding mechanism and other entities such as state certification processes were not explored by this literature review.

From this literature review, it can be seen that the government is providing telecommunication relay services as part of civil rights legislation to protect and enhance social and economical rights for those who are unable to access to the conventional telephone system. Throughout history, the FCC and telecommunications industry were reluctant to provide access for those unable to use it. Thus, relay mandates were enacted to regulate telecommunications carriers and service providers to help assure access, so that deaf and hard of hearing people can enjoy the same privileges available to voice telephone users. However, several key obstacles for telecommunications accessibility still remain, especially for information services and mandatory minimum standards because there is a lack of legal mandates for assuring access to information services such as voicemail, conference calls, and interactive voice or automated prompt systems that are widely used in society today. Due to lack of evaluation data and oversight by the government, information regarding shortcomings and benefits of telecommunications relay services in the United States is not available. Thus, the key obstacles for achieving functionally equivalent telecommunications relay services must be investigated further.

Since limited literature and studies regarding the outcomes and benefits of telecommunication relay services and video relay services in the United States is

available, it is unknown whether or not VRS actually provides a better relay experience compared to the existing text-based telecommunication relay services for deaf and hard of hearing individuals. To answer the primary research question of whether or not VRS serves as a "functionally equivalent" access to telecommunications, a new study needs to be conducted. The present study reported here was undertaken to explore how VRS is utilized among deaf and hard of hearing professionals at the National Technical Institute for the Deaf at Rochester Institute of Technology. This thesis will present a comparative analysis of whether deaf and hard-of-hearing people are satisfied with text-based relay services or video relay services to answer my primary research question: does VRS provide functionally equivalent telephone access for the deaf?

3.0 Methodology

The primary purpose of this research reported here was to understand how Video Relay Services (VRS) are utilized among deaf and hard of hearing professionals at the National Technical Institute for the Deaf (NTID) and Rochester Institute of Technology (RIT). In addition, this thesis explores whether or not VRS provides a "functionally equivalent" means of access to telecommunications for deaf and hard-of-hearing citizens. This section will present an analytical framework of how this study is conducted and how the data is collected and analyzed to generate policy recommendations.

3.1 Analytical Framework

In order to establish the analytical framework for this research, the following steps were taken. First, relevant research studies conducted in similar topics regarding access technologies for the Deaf were reviewed. Second, the survey framework was

developed based on frameworks established in prior research studies. Third, subjects were selected and pilot-tested prior to the actual data collection. This section will discuss how the survey questionnaire was developed and subjects selected for establishing the analytical framework for this study.

3.1.1 Relevant Research Studies

A limited number of studies on telecommunication relay services in the United States were published. Thus, I expanded the scope to access technologies used by the deaf population in general.

Bowe (1991) conducted a national study of 128 deaf and hard-of-hearing individuals with an age range between 18 and 70 years regarding telephone services. Bowe used a list of information services and telecommunication products available at that time, and asked the respondents to rate their interest of each item. His finding strongly indicated that deaf and hard of hearing people were frustrated with inadequate access to the telecommunication network. The study was conducted one year prior to the establishment of the nationwide telecommunication relay services due to the enactment of Title IV of the Americans with Disabilities Act (ADA).

Bowe (2002) conducted a follow-up study 10 years after his original study (Bowe, 1991). This time, he conducted an online survey of 884 deaf and hard-of-hearing individuals regarding their experiences using instant messaging (IM) and e-mail. He wanted to see if there was a disparity between home and work use. His finding showed that respondents were using e-mail and IM far more than TTY and relay services, with the dominance of e-mail and IM use at home and the use of IM at work less frequent due to office policies that restrict the use of IM.

Des Power, Mary R. Power, and Louise Horstmanshof (2007) also used a similar framework. They conducted a study regarding Australian Deaf people communicating via electronic media such as text messages (SMS), TTY, relay services, fax, and computers. Their subjects were 172 members (56.4% response rate) of the Australian Association of the Deaf who they queried via mailed survey. Their findings showed few statistically significant differences regarding age, gender, or level of education as regards to the use of electronic communication among deaf and hard of hearing people in Australia. The authors noted that these findings could be limited for its generalizability to the wider deaf community. The respondents were very active members in the community who tended to be more educated compared to the general population.

Based on the literature review of relevant research studies regarding this topic, the following criteria for survey development were identified. First, a list of information services needed to be created. Second, a comparative analysis between work and home needed to be conducted to determine if there was a disparity in the use of Video Relay Services (VRS) and Text-based relay services. Finally, differences in age, gender, or communication method were explored to see if there was any statistical significance.

3.1.2 Survey Development

In order to generate a list of information services, I consulted two committee members who are Deaf: Mr. Scot Atkins, Director of Organizational Development and Human Resources at Interpretek (who has a wealth of knowledge in policy development regarding TRS), and Dr. Denise Kavin, Senior Project Associate at PEN-International, NTID, RIT (who has a wealth of knowledge regarding deaf and hard of hearing individuals in academia). After several meetings with these committee members, the

committee determined the following information services should be explored: 1) voicemail; 2) interactive voice recordings (IVR) which is also recognized as automated prompt messages; 3) a conference call (3-way or more); 4) International call (including Canada and Mexico).

In addition, these committee members felt that it would be beneficial to learn whether deaf and hard of hearing people still have TTYs, use wireless devices to receive message through VRS, or whether they configure equipment to access VRS on their own. Voice Carry Over (VCO) is gaining popularity for those who prefer to communicate using their own voice, so these committee members suggested exploring whether deaf and hard-of-hearing individuals prefer to use VRS over the traditional text-based relay services to access VCO. To be consistent with the framework established by prior research studies, I also used an analytical framework of home/work use for this study. I employed the following scale for frequency of use: Always (everyday), Often (a few times a week), Sometimes (once a week or less), Rarely (once a month or less), or Never (none of the above), to explore how deaf and hard of hearing people utilize relay services.

Furthermore, the thesis committee suggested that it would be beneficial to compare text-based and Video Relay Services (VRS) regarding access to information services, technical support/set-up and the quality of services (attitudes of operators, wait-time, and typing speed/sign quality) to see if legislative actions such as Section 225 and Section 255 that established minimum standards and extended protections toward certain information services such as voice mail and automated prompt messages were effective. Also, the committee suggested exploring if Bowe (2002)'s finding regarding the TTY use were more relevant after VRS emerged in 2002.

After developing the draft survey, the questionnaire was pilot tested on 7 deaf and hard of hearing individuals selected according to age (aged from 23 to 64) who were not associated with the National Technical Institute for the Deaf/Rochester Institute of Technology. The purpose of the pilot study was to ensure clarity and integrity of the questions in written English as well as to eliminate internal bias and errors. Several suggestions regarding technical terms and wordings were made and these suggestions were incorporated in the final draft. Finally, a copy of the questionnaire was submitted to the Institute Review Board (IRB) for approval. No changes were suggested when IRB approval was received. Thus, I proceeded to data collection. (Please see Appendix A for the final version of survey questionnaire distributed online).

3.1.3 Subject Design

Often it is very difficult to have access to a pool of deaf and hard of hearing individuals that belong to different age groups at one place. Fortunately, I am employed at the National Technical Institute for the Deaf (NTID) at Rochester Institute of Technology (RIT) in Rochester, New York. NTID has been a pioneer for communication accessibility since it was founded in 1967 at RIT.

Since 1967, NTID has been an early adopter of communication technologies for the deaf. In early 1969, 6 Victor Electrowriters were installed in strategic spots on the campus of RIT, which allowed deaf and hearing people to use the telephone through an electric stylus system (Lang, 2001). In addition, NTID also experimented with a picture-telephone "Vistaphone" donated by Rochester based Stromberg-Carlson corporation for field-testing and evaluation.

Currently, 99 faculty and staff members who are deaf and hard-of-hearing are employed at NTID, along with 1102 deaf and hard-of-hearing students (National Technical Institute for the Deaf, 2008). NTID/RIT is the world's largest technical college for deaf students and one of the largest employers of deaf and hard-of-hearing individuals in the United States. Due to its large population of deaf and hard-of-hearing employees and its history of adopting access technologies for the Deaf, NTID provided an excellent environment for the current study.

Due to size of the population, using a survey is an appropriate approach to collecting data from this large pool of deaf and hard-of-hearing employees. Even though current students who are deaf and hard of hearing might be eligible for this survey study, they were excluded from this survey because many of them do not have work experience which was an important variable in this study.

3.2 Data Collection Techniques

In order to distribute the questionnaire, I utilized Rochester Institute of Technology's online survey application called Clipboard. This tool offered numerous advantages. Many RIT/NTID employees are familiar with the interface, thus it provided ease of use as well as prompt speed of responses within the limited timeframe. In addition, there was no charge for institutional use.

All deaf and hard-of-hearing employees at NTID/RIT belong to an organization called Deaf Professional Group (DPG). An email which contained an informed consent form and a link to the actual survey was sent out by me to the DPG email distribution list on April 9, 2008.

By the end of the 1st week after the initial request was sent out, I received 25 responses (approximately 25% response rate). On April 21, the first reminder was sent. By the end of the 2nd week, I received a total of 35 responses (approximately 35% response rate). A second reminder was sent out on April 25 with the announcement of the final deadline of April 28. I received a total of 44 responses (approximately 44% response rate) and consulted with his thesis advisor who agreed that the response rate was satisfactory. As a result, the URL was disabled, so that people would not be able to access the survey tool any more.

3.3 Analysis

3.3.1 Data Input and Cleaning

Soon after the URL for the survey was disabled, the collected data was entered on an Excel spreadsheet. The Excel spreadsheet generated by the Clipboard was not neatly organized, so I rearranged rows and columns by each group of questions for the purpose of analysis. I went through each response, and made sure the input was robust and valid. One respondent chose not to respond to the questionnaire after the subject filled out demographic information. Thus, this particular respondent was eliminated from the final dataset. If a specific entry was missing, I identified a missing entry with a highlighted label, so that I would be able to mention the missing item when analysis was conducted.

3.3.2 Data Analysis

First, I focused on descriptive statistics, which are discussed in the following chapter. Demographic information, comparison of telecommunications relay services use at work and at home, and comparison of text-based relay services and Video Relay

Services, are presented, and the results are discussed with graphical charts and descriptions of the data. I used SPSS for conducting data analysis after I cleaned up and prepared the final dataset.

The data analysis, which will be discussed in chapter five, has two key components. The first component details a comparative analysis of how telecommunications relay services (VRS and text-based relay services) are utilized at work and home using the framework discussed earlier. Pairwise t-tests were conducted to see if there was any statistical significance between work and home use. Then, I continued to explore if there was any statistical significance based on a difference in profession (between faculty and staff), gender (between male and female), communication preference (between a group using sign only or using sign and speech together), and age (between an age group of 30-39 and 50-59) using independent t-tests.

The second component includes a comparative analysis between text-based relay services and Video Relay Services (VRS) regarding satisfaction of use. I employed the same analytical framework using demographic factors as a base framework for this study. Through the literature review, I realized that the government has not established any clear definition of the term "functionally equivalent" access. In addition, the FCC has not established any specific long-term measures to evaluate "functionally equivalent" access to telecommunication services for the deaf. Thus, I utilized a satisfaction metric in my survey to see if there's a link to "functionally equivalent" access to answer the primary research question of this thesis.

Some researchers recognized utilizing non-parametric technique for the "posteriori analysis" of ordinal data (Conover, 1971). The department chair suggested the

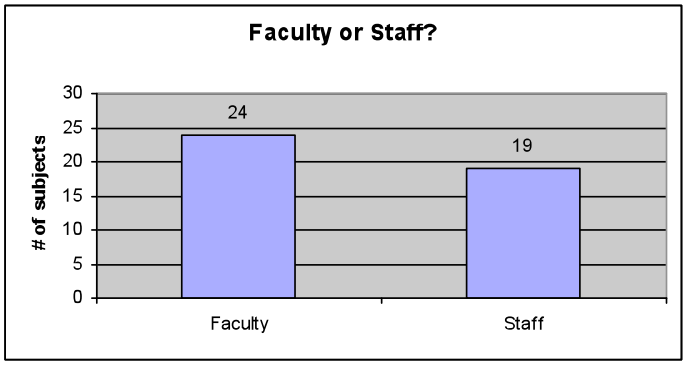
use of students' t test using pairwire t-tests and independent sample t-tests. Thus, data analysis was conducted using the following tests. Discussion and policy recommendations are made in the final chapter.

4.0 Descriptive Statistics

This section provides descriptive statistics from the survey distributed among deaf and hard-of-hearing professionals at NTID/RIT. Demographic information and overview of the results from the survey are discussed in this chapter. The purpose of this chapter is to present a broader understanding of the subjects and rationales for further analysis.

4.1 Demographic information

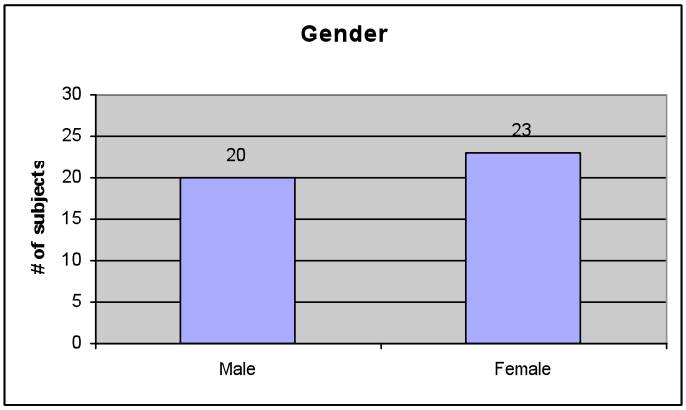
The survey was conducted among deaf and hard-of-hearing professionals at the National Technical Institute for the Deaf, the largest technical college for the deaf in the world. This section details the distribution of the sample population regarding gender, hearing status (deaf or hard of hearing), age, communication preference, and level of education. The total number of the respondents is 44; however, one person decided not to complete the survey and this left 43 usable responses.



Graph 4.1: Subject distribution by faculty/staff status (n=43)

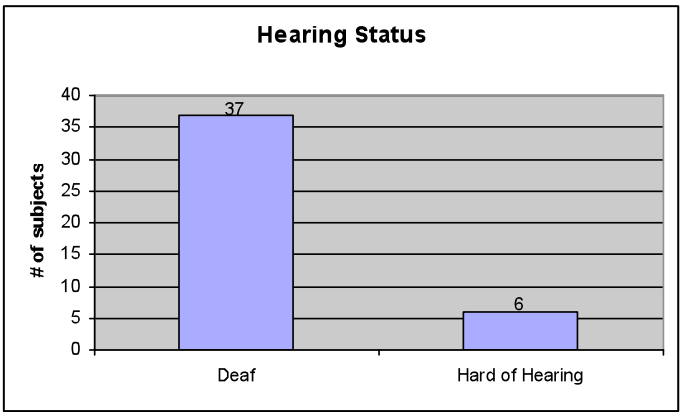
As shown in graph 4.1, 24 faculty members (56% of the sample population) and 19 staff members (44% of the sample population) participated in the survey study. There were a total of 99 possible faculty and staff respondents. Considering this survey was distributed within a limited timeframe, there was a good response rate (44%).

The sample population has a slightly higher number of female (n=23) than male (n=20) professionals. According to the FY2007 NTID annual report, out of 570 NTID faculty and staff members, 394 individuals (69.1% of the population) are female (p. 144 of the FY2007 NTID annual report). Data regarding deaf and hard of hearing employees' gender ratio was not available in the annual report; however, this subject distribution is suitable for further analysis.



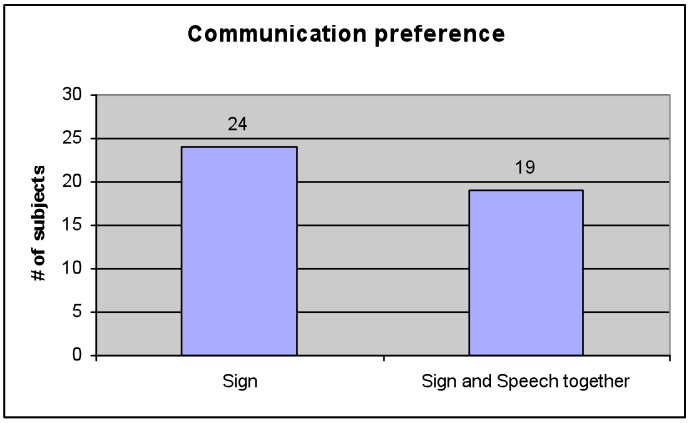
Graph 4.2: Subject distribution by gender (n=43)

Graph 4.3 shows the sample distribution based on hearing status. I asked the respondents if they identify themselves as either deaf or hard-of-hearing. The sample population consists of predominantly of deaf employees rather than hard-of-hearing. There might be some deaf individuals who function as "hard of hearing" in a medical sense. Thus, it is critical to ask how each respondent communicate.



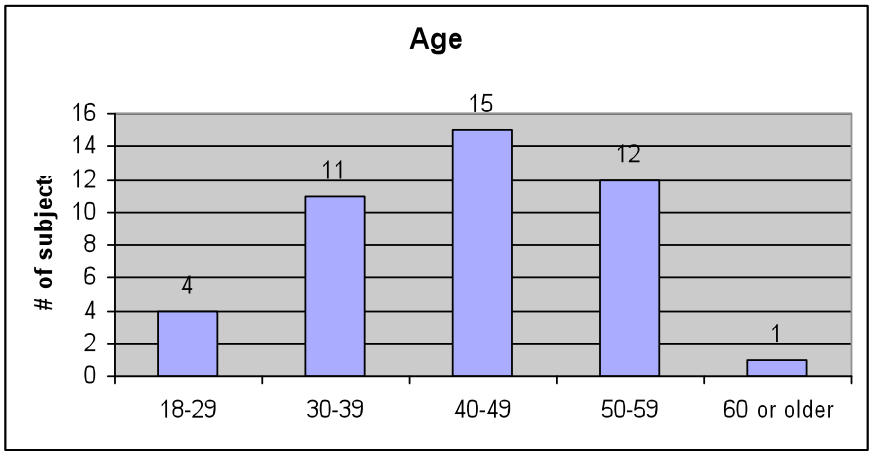
Graph 4.3: Subject distribution by hearing status (n=43)

Graph 4.4 shows that slightly more people prefer to communicate using sign only (n=24, 56% of the sample population) while others prefer to communicate using sign and speech together (n=19, 44% of the sample population). As discussed earlier in the literature review section, a person's self identification as either deaf, hard of hearing, or hearing impaired is often a personal choice and does not necessarily represent the degree of hearing loss. The most important aspect is to realize how each individual prefers to communicate with others as self identity and communication preference are not necessary correlated.

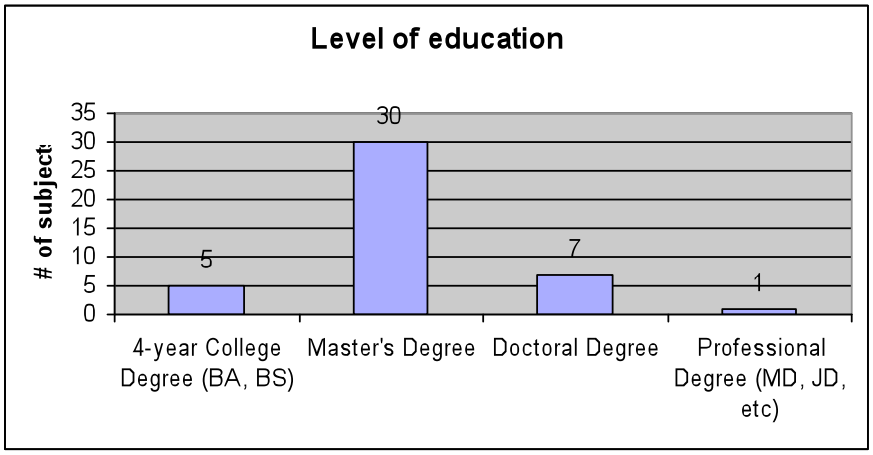


Graph 4.4: Subject distribution by communication preference (n=43)

Five different age-groups (18-29, 30-39, 40-49, 50-59, 60 or older) in a Likert scale format were established for the purpose of this study. A visual inspection of graph 4.6 indicates that the sample population appears to ape a normal curve.



Graph 4.5 -- Age-group distribution of the subjects (n=43)



Graph 4.6 -- Highest level of education completed by the subjects (n=43)

Graph 4.6 shows that a majority of respondents hold at least Master's degree (n=30, 70%), while others hold at least four-year college degrees or doctorate degrees. All the respondents hold college degrees. Considering the National Technical Institute for the Deaf is a higher educational institution, this finding is not unusual. This finding indicates that all the respondents are college educated and most of them hold advanced

degrees beyond bachelor's degrees. Thus, it is not safe to assume that the finding of this report can be generalized to the deaf population elsewhere in the United States.

From the descriptives of demographic information (please see Appendix B for a full list of descriptive statistics of demographic information), it is evident that we cannot generalize the finding of this survey to any other organizations because we do not find any other employers that hire a large number of deaf and hard of hearing individuals with advanced degrees such as NTID and RIT. In this aspect, NTID/RIT is an unique employer for deaf and hard of hearing individuals.

4.1.1 Ownership of Videophone (VP), VRS-Capable Computer, or TTY at Work

In order to conduct an accurate pairwise comparison between home and work use, I asked the respondents whether they had standalone videophone equipment, a VRS capable computer, or TTY. Almost everyone (98% of the sample population, n=42) except one (2% of the sample population, n=1) respondent had videophone at work.

On the other hand, not everyone has a VRS capable computer. Two thirds of the sample population (65%, n=28) has a VRS capable computer with a webcam at work, while the rest of the sample population (35%, n=15) do not. Individuals without a VRS capable computer are still able to access VRS through videophone equipment, but I asked the respondents this question to be certain they had a medium to access VRS. Also, the respondents were asked whether they use a TTY at work. The purpose of this question was to check Bowe's (2002) claim that the TTY is less frequently used now because email or IM are more commonly used among deaf and hard of hearing people. More than a half of the respondents (62.8%, n=27) indicated that they no longer use TTY at work. The rest of the group (37.2%, n=16) responded that they are still using TTY at work.

4.1.2 Ownership of Videophone (VP), VRS-Capable Computer, or TTY at Home

I also asked whether respondents own videophone, VRS-capable computers, or TTY at home (or residence). I used this analytical framework to be consistent with the analytical frameworks presented by other scholars in this area of research, which was discussed earlier in the methodology section. A majority of subjects (95.3%, n=41) responded that they have stand-alone videophone equipment at home, while only 2 subjects do not. Unlike at work, the ownership of VRS-capable computers was greater at home (48.8%, n=21). This might indicate that many deaf and hard-of-hearing employees access to VRS using their computers at home because of the flexibility that personal computers provide. As well as at work, more than a half of the respondents (58.1%, n=25) indicated that they no longer use TTY at home. The rest of the group (41.9%, n=18) responded that they are still using TTY at home.

4.2 Telecommunications Relay Services Use at Work/Home

This section details how deaf and hard of hearing employees at NTID utilize video relay services at work and at home. First, I asked respondents to rate how frequently they make incoming and outgoing calls using VRS. Second, I asked how often respondents access information services available for hearing callers (voicemail, automated message, conference call, international call, and access to services via wireless devices) using VRS. Third, I asked respondents how often they configure equipment to access VRS. Finally, I asked how often they use text-based relay services and Voice Carry Over services if any.

In order to measure frequency, a Likert-scale (5 scale) was used. Subjects were asked to rate their frequency of utilizing services from ***Always*** (everyday), ***Often*** (a few

times a week), ***Sometimes*** (once a week or less), ***Rarely*** (once a month or less), to ***Never*** (not at all). I assigned a value of 4 to the highest rank, and 0 to the lowest rank for statistical analysis discussed in the next chapter. The highlighted yellow cells indicate that a majority of respondents selected a particular scale (please see Appendix C for a full list of descriptive statistics of work and home use analysis discussed in this chapter)

4.2.1 Incoming and Outgoing Calls

First, I investigated if there was any specific pattern for outgoing versus incoming calls using VRS. Chart 4.1 shows that respondents are making more outgoing calls at work compared to at home. On the other hand, a majority of respondents indicated that they receive less incoming calls using VRS both at work and home as shown on Chart 4.2.

Outgoing calls	N	Always	Often	Sometimes	Rarely	Never
Work	43	20.9%	39.5%	30.2%	9.3%	0.0%
Home	43	23.3%	27.9%	34.9%	7.0%	7.0%

Chart 4.1: Frequency of outgoing calls using VRS

Incoming calls	N	Always	Often	Sometimes	Rarely	Never
Work	43	2%	14%	40%	37%	7%
Home	43	12%	16%	37%	23%	12%

Chart 4.2: Frequency of incoming calls using VRS

4.2.2. Information Services

Second, I investigated if respondents use voicemail and interactive voice recordings (automated message) that were supposed to be made accessible due to the Section 255 of the Telecommunications Act of 1996. Chart 4.3 and 4.4 show that a majority of respondents indicate that they never use voicemail or access to automated messages using Video Relay Services (VRS) both at work and at home. This suggests that either these services are not yet accessible via VRS or the respondents simply do not

prefer to use or access to these services. Another possibility is that the respondents were not aware that these services could be accessible via VRS.

Voicemail	N	Always	Often	Sometimes	Rarely	Never
Work	43	5%	2%	5%	12%	77%
Home	43	2%	2%	2%	5%	88%

Chart 4.3: Frequency of accessing to voicemail using VRS

Auto. Message	N	Always	Often	Sometimes	Rarely	Never
Work	43	2%	0%	9%	12%	77%
Home	43	2%	2%	0%	5%	91%

Chart 4.4: Frequency of accessing to automated message using VRS

Chart 4.5, 4.6 and 4.7 show that a majority of respondents indicate that they use neither conference call nor international call using VRS. Also, they do not utilize wireless devices to receive VRS calls. It is critical to note that more respondents utilize conference call and use wireless devices to receive messages through VRS at work. This could be due to the nature of work that requires communication on an ongoing basis. However, a majority of respondents still do not have or rarely use these services. As more and more people utilize conferencing and international calls especially for business purposes in a globalizing information society, access to these services are critical for deaf and hard of hearing employees in the future.

Conf. Call	N	Always	Often	Sometimes	Rarely	Never
Work	*42	0%	0%	7%	23%	67%
Home	43	0%	0%	5%	2%	93%

- 1 Missing Value

Chart 4.5: Frequency of accessing to conference calls using VRS

Intl. Call	N	Always	Often	Sometimes	Rarely	Never
Work	43	0%	0%	2%	14%	84%
Home	43	0%	0%	2%	12%	86%

Chart 4.6: Frequency of accessing to international calls using VRS

Wireless Msgs	N	Always	Often	Sometimes	Rarely	Never
Work	43	9%	2%	7%	14%	67%
Home	43	12%	7%	5%	7%	70%

Chart 4.7: Frequency of accessing to VRS messages via wireless devices

4.2.3 VRS Equipment Configuration

Third, I investigated if respondents configure equipment to access VRS on their own. Chart 4.8 shows that a majority of respondents never configure VRS equipment on their own. About half of the respondents indicate that they configure equipment on their own either at work or at home rarely or sometimes. This finding might be useful in understanding if respondents feel comfortable with setting up equipment to access VRS which is clearly more complicated than setting up traditional telephone equipment for hearing individuals.

Configuration	N	Always	Often	Sometimes	Rarely	Never
Work	43	2%	0%	16%	23%	58%
Home	43	2%	7%	16%	30%	44%

Chart 4.8: Frequency of configuring equipment to access to VRS

4.2.4 Text-based Relay Services

Even though the primary purpose of this study is to understand how VRS is utilized, I asked how often respondents use text-based relay services. As Bowe indicated in his 2002 research regarding instant messaging (IM) and e-mail use, a majority of respondents rarely use text-based relay services at work as shown on Chart 4.9. As Bowe also pointed out on his article, his subjects indicated that they were no longer using text-based relay services at home (even though they might have had in the past). This finding shows that deaf and hard of hearing people are shifting to video relay services or possibly to other two-way communication alternatives and away from traditional text-based relay services.

Text-based Relay	N	Always	Often	Sometimes	Rarely	Never
Work	43	7%	12%	21%	33%	28%
Home	43	7%	16%	16%	23%	37%

Chart 4.9: Frequency of using text-based relay services

4.2.5 Voice Carry Over (VCO)

As mentioned earlier in this section, a person's self identification as either deaf, hard of hearing, or hearing impaired is a personal choice and does not represent a function or degree of hearing loss. Thus, I investigated whether Voice Carry Over (VCO) is utilized among deaf and hard of hearing employees at NTID because some individuals might utilize VCO even though they consider themselves deaf. The findings suggest that most respondents never use these services both at work and at home. Chart 4.11 shows that there are slightly more individuals who utilize VCO via VRS.

VCO via VRS	N	Always	Often	Sometimes	Rarely	Never
Work	43	7%	2%	2%	5%	84%
Home	43	5%	2%	9%	2%	81%

Chart 4.10: Frequency of using VCO via VRS

VCO via Text-based Relay	N	Always	Often	Sometimes	Rarely	Never
Work	43	2%	2%	0%	2%	93%
Home	42	2%	2%	0%	2%	93%

Chart 4.11: Frequency of using VCO via Text-based relay services

4.3 Comparison of Satisfaction between Text-based relay and VRS

This section details the level of satisfaction using Text-based relay services and Video Relay Services (VRS). The respondents were asked to rate their level of satisfaction, from Very satisfied to Very dissatisfied, to each question described below. I also added a section of "Does not apply" because some respondents may have never utilized particular telecommunication or information services. In this case, the respondents may not possess the experience to rate their level of satisfaction, so I added an additional scale to ensure that respondents could describe their level of satisfaction. The highlighted yellow cells indicate that a majority of the respondents selected this particular level of satisfaction. I assigned a value of 4 to the highest rank, and 0 to the

lowest rank for statistical analysis. If "Does not apply" was selected, I assigned no value to it because this response cannot be included in analysis. (please see Appendix D for a list of chart for gratification analysis)

4.3.1 Quality of Services

First, I asked the respondents if they are satisfied with typing speed of text-based relay and with signing quality of video relay services. The primary purpose of these questions is to understand if the quality of typing speed or signing has improved over time since Title IV of the ADA was enacted. A majority of respondents indicated they are satisfied with either typing speed or sign quality of services. This might be a good progress since the TRS mandatory minimum operational, technical, and functional standards were established. Typing speed of text-based relay services and sign quality of video relay services is a critical element for ensuring the quality of relay services because these are equivalent to the speed or quality of voice of hearing callers.

Typing Speed	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied	Does not apply
Text-based relay	43	14.0%	39.5%	25.6%	7.0%	4.7%	9.3%

Chart 4.12: Gratification of typing speed of operator for text-based relay services

Sign Quality	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied
VRS	43	9.3%	67.4%	16.3%	7.0%	0.0%

Chart 4.13: Gratification of sign quality of operator for Video Relay Services (VRS)

Second, I asked if respondents are satisfied with the ability of hearing callers to reach them. Chart 4.14 showed a mixed response for this question, especially with text-based relay services. With text-based relay services, a wide range of responses were received because about the same proportion of respondents indicated that they are either

satisfied, neutral, dissatisfied, or not applicable (this might suggest that the respondents might have never used text-based relay services, or have not used it for a while, so that they have no opinion toward the use of text-based relay services).

Many respondents indicated that they are either satisfied or that the question was not applicable to them. This finding might be parallel to what I discovered regarding the frequency of incoming calls both at work or at home. More than half of the respondents indicated they only receive incoming calls via VRS rarely (once a month or less) or sometimes (once a week or less). If deaf and hard of hearing individuals feel that they are not accessible to hearing callers, then functionally equivalent access has not been achieved.

Hearing Caller	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied	Does not apply
Text-based relay	43	2.3%	23.3%	23.3%	20.9%	4.7%	25.6%
VRS	43	9.3%	27.9%	18.6%	7.0%	4.7%	32.6%

Chart 4.14: Comparison of Gratification for ease of access for hearing callers to reach deaf callers

In addition, the respondents were asked if they are satisfied with attitudes of relay operators and wait time to make a relay call. A majority of the respondents indicated that they are either satisfied or neutral as regard the attitude of operators or wait time of both text-based and video relay services. Chart 4.15 and 4.16 shows that VRS provides slightly more gratification compared to text-based relay service. In the literature review, wait time and attitude of operators were critical issues that prevented deaf and hard of hearing people from equal access to telecommunication services. These findings might suggest that that they are less dissatisfied or very dissatisfied with services in general.

Attitude of Operator	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied	Does not apply
Text-based relay	43	7.0%	39.5%	27.9%	11.6%	0.0%	14.0%
VRS	43	16.3%	53.5%	20.9%	2.3%	0.0%	7.0%

Chart 4.15: Comparison of Gratification for attitudes of relay operators

Wait time	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied	Does not apply
Text-based relay	43	9.3%	44.2%	20.9%	7.0%	9.3%	9.3%
VRS	43	4.7%	51.2%	25.6%	7.0%	7.0%	4.7%

Chart 4.16: Comparison of Gratification for wait time for accessing relay services

4.3.2 Information Services

Chart 4.17 and 4.18 show almost all respondents indicate that the questions regarding voicemail and automated messages are not applicable to them.

Access to Voicemail	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied	Does not apply
Text-based relay	43	0.0%	7.0%	4.7%	2.3%	2.3%	83.7%
VRS	43	0.0%	14.0%	0.0%	0.0%	0.0%	86.0%

Chart 4.17: Comparison of Gratification for access to voicemail

Access to IVR	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied	Does not apply
Text-based relay	43	0.0%	11.6%	2.3%	11.6%	7.0%	67.4%
VRS	43	7.0%	18.6%	0.0%	2.3%	0.0%	72.1%

Chart 4.18: Comparison of Gratification for access to recorded messages (IVR)

As a majority of respondents indicated that they never use these information services that are supposed to be more accessible according to the section 255 of the Telecommunication Act of 1996.

4.3.3 Setting Up Equipment/Technical Support

Chart 4.19 and 4.20 show a significant disparity between text-based relay service and video relay services regarding the level of gratification of technical support and setting up equipment for accessing relay services. Most respondents indicated they feel that the questions regarding technical support and setting up equipment are not applicable to them because the services might be ready for them when they use. On the other hand, accessing video relay services require a technical set up and ongoing technical support because of how Video Relay Services can be accessed (basic knowledge of networking for setting up videophone or computer application is required).

Technical Support	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied	Does not apply
Text-based relay	43	0.0%	16.3%	27.9%	4.7%	2.3%	48.8%
VRS	42*	4.8%	50.0%	16.7%	2.4%	4.8%	21.4%

Chart 4.19: Comparison of Gratification for technical support provided by relay services providers
*1 missing value

Setting up equipment	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied	Does not apply
Text-based relay	43	7.0%	27.9%	20.9%	7.0%	0.0%	37.2%
VRS	43	9.3%	39.5%	23.3%	2.3%	0.0%	25.6%

Chart 4.20: Comparison of Gratification for setting up equipment to access relay services

4.4 Summary of Descriptive Statistics

In sum, 44 respondents out of 99 faculty and staff at National Technical Institute for the Deaf (NTID) participated in this study with a sample response rate of 44%. This is a sufficient response rate considering this is a unique group, which does not exist elsewhere in the United States. One respondent was removed during the data input process because the respondent decided not to complete the survey. Respondents were

college educated; the vast majority possessed master's degrees or doctoral degrees. Many of them identified themselves as "deaf"; however, about 50 % of the sample population answered they prefer to communicate using both sign and speech together. The age distribution of the sample population appears to be a normal distribution with a median group of 40-49.

Regarding ownership of standalone videophone equipment, VRS-capable computer, and TTY, almost all respondents owned standalone videophone equipment to access VRS both at work and at home. On the other hand, more respondents own VRS-capable computers at home while less of them own the VRS-capable computers at work. In addition, more than 50% of the respondents no longer use TTY both at work and at home.

The study found that respondents make more outgoing calls at work compared to at home while many of them receive few incoming calls from hearing callers both at work and at home. Almost all respondents indicated that they do not utilize information services such as voicemail and interactive voice recording (or automated voice messages). A majority of respondents also indicated that they do not use conference calls, international calls, or wireless devices to receive VRS messages, or use VCO.

More than 50% of the respondents indicated that they rarely or never use text-based relay services either at work or at home. This indicates that a transition from text-based relay services to Video Relay Services is in progress. However, many never configure equipment by themselves, so they might be dependent on technical support for help in case equipment is out of order.

The study also shows that a majority of respondents are either satisfied or neutral with typing speed of operators for text-based relay services and sign quality of video relay services. However, respondents had a mixed range of response regarding hearing callers reaching them for both text-based relay services and VRS. I feel that a mixed range of responses represents some respondents has a strong degree of frustration toward the issue while others experience different degrees of frustration. Still, this might pose a critical barrier in accomplishing truly functionally equivalent access for telecommunications.

Moreover, respondents are satisfied with attitude of operators and wait time, even though there is a slight advantage for VRS compared to text-based relay services. Many respondents indicated that they never use voicemail and automated message. Almost half of the respondents indicated that they are satisfied with technical support and equipment setup for VRS while a majority of respondents indicated the questions are not applicable for text-based relay services.

Having established how VRS is utilized and having compared gratification of text-based relay services, I moved forward to data analysis using t-test between work and home use. This will be discussed in the next chapter. In addition, I conducted data analysis to see if there is any statistical difference regarding their profession, gender, communication method, and age.

5.0 Data Analysis

This section presents statistical analyses, and has two components. The first component presents analysis to determine if there is a difference between utilization of VRS and text-based relay services at home and at work. If there is a statistically

significant difference, these items are discussed with further analysis provided by me. If I discovered relevant findings of other scholars (see 3.1.1. Relevant Research Studies), they are discussed.

The second component details the comparison of satisfaction of text-based relay services and video relay services by respondents' demographic characteristics (profession, gender, and communication method).

5.1 Work and Home Use Analysis

I had to make sure each respondent had means of accessing Video Relay Services for conducting an accurate pairwise comparison. I checked whether each respondent had means of accessing VRS by asking each respondent if he or she had stand alone videophone equipment or a VRS-capable computer (See Appendix A, Q7-9, Q21-23). Among 43 valid respondents, three indicated that they had no means of accessing VRS either at work or home, or both. Thus, I removed these three respondents from pairwise t-test. Each table has a row of a mean (X), a mean difference (X diff), a level of significance (Sig. 2 tailed), and t-score (t). The highlighted yellow cells indicate that a difference is statistically significant.

5.1.1 Outgoing calls vs. Incoming Calls

Chart 5.1 shows that a difference between work and home use regarding making outgoing calls using VRS is not statistically significant. Most respondents make outgoing calls at least a few times per week. On the other hand, I discovered that respondents receive less incoming calls, i.e., about once a week or less. The difference is small, but it

is statistically significant at the 95 percent confidence level for receiving incoming calls using VRS. This suggests there's still a discrepancy between outgoing and incoming calls.

Question	N	X	X diff	Sig. (2 tailed)	t	
Outgoing calls						
Work	40	2.73				
Home	40	2.70	.025	.860	.177	
Incoming calls						
Work	40	1.65				
Home	40	2.05	-.400	.016	-2.511	*

* statistically significant at the 95 percent confidence level

Chart 5.1 Pairwise Comparison of Outgoing/Incoming Calls

5.1.2 Information Services

Chart 5.2 shows a list of pairwise comparison regarding information services. As discussed in the previous chapter, most respondents never use the following information services such as voicemail, IVR (automated voice recordings), conference calls, international calls and wireless VRS messages.

Question	N	X	X diff	Sig. (2 tailed)	t	
Voicemail						
Work	40	.48				
Home	40	.28	.200	.103	1.669	
Auto. Message						
Work	40	.40				
Home	40	.23	.175	.213	1.267	
Conf. Calls						
Work	^39	.41				
Home	^39	.08	.333	.001	3.606	**
Intl. Calls						
Work	40	.20				
Home	40	.18	.025	.711	.374	
Wireless Msgs						
Work	40	.70				
Home	40	.90	-.200	.198	-1.309	

^ 1 missing value – total of 39 pair for comparison

** statistically significant at the 99 percent confidence level

Chart 5.2 Pairwise Comparison of Information Services

Among them, I found that the difference between initiating conference calls at work and at home is statistically significant at the 99 percent confidence level. This might suggest that more respondents have participated in conference calls as part of their work.

5.1.3 VRS Equipment Configuration

To access VRS, some knowledge of equipment configuration is required. Chart 5.3 shows that respondents configure equipment at home more than so at work.

Question	N	X	X diff	Sig. (2 tailed)	t	
Config Eqpt.						
Work	40	.68				
Home	40	.98	-.300	.050	-2.020	*

* statistically significant at the 95 percent confidence level

Chart 5.3 Pairwise Comparison of VRS Equipment Configuration

The difference between work and home use is statistically significant at the 95 percent confidence level. This is reasonable because on-site technical support is provided on the campus of NTID/RIT. VRS agencies provide technical support for residences; however, receiving on-site technical support promptly at home is more difficult than on-campus. However, most respondent rarely configure their VRS equipment.

5.1.4 Text-based Relay Services

In contrast to VRS, I queried the subjects regarding the use of text-based relay services. A majority of respondents indicated that they rarely or never use text-based relay services.

Question	N	X	X diff	Sig. (2 tailed)	t
Text relay use					
Work	40	1.35			
Home	40	1.40	-.050	.762	-.305

Chart 5.4 Pairwise Comparison of Text-based Relay Services

As shown on the chart 5.4, the difference between work and home use is not statistically significant. This suggests that a majority of respondents no longer use text-based relay both at work or home.

5.1.5 Voice Carry Over (VCO)

I explored whether Voice Carry Over is utilized among deaf and hard of hearing employees at NTID. A majority of respondents indicated that they never use VCO that requires use of their own voice to access telecommunications relay services even though 44% of the respondents prefer to communicate using both sign and speech. This suggests that communication method of each respondent (whether someone prefers to use his or her own voice) is not relevant to the use of VCO. Chart 5.5 shows that the difference is not statistically significant.

Question	N	X	X diff	Sig. (2 tailed)	t
VCO via VRS					
Work	40	.48			
Home	40	.50	-.025	.711	-.374
VCO via Text					
Work	39*	.21			
Home	39*	.21	.000	1.000	.000

Chart 5.5 Pairwise Comparison of Voice Carry Over via VRS/Text

5.2 Demographic Factor Analysis on Work and Home Use

I explored whether there is any statistical significance regarding demographic characteristics of the respondents. Other scholars found few statistically significant differences regarding age, gender, or level of education. Irrespective, this author explored their relevance to this study.

However, I decided not to conduct an analysis based on a level of education because most respondents hold Master's degrees or above. Instead, I decided to see if a

difference in professions (faculty or staff) and communication methods (using sign only or sign/speech together) exist as well as a difference in gender (male or female) and age (30-39 or 50-59).

The only items that are statistically significant are discussed in the following section. However, the full SPSS analysis tables are available for reference in Appendix F to H.

5.2.1 Factor Analysis Based on Profession

Chart 5.6 shows those paired comparisons that are statistically significant. These findings indicate that faculty members are more likely to utilize VRS in general. The trend was evident in both outgoing and incoming calls. The difference in profession regarding making outgoing calls at work is statistically significant at the 99 percent confidence level and incoming calls at work is also statistically significant at the 95 confidence level.

Question	N	X	X diff	Sig. (2 tailed)	t	
Work Outgoing Calls						
Faculty	18	3.22				
Staff	22	2.32	-.904	.001	-3.447	**
Work Incoming Calls						
Faculty	18	2.00				
Staff	22	1.36	-.636	.023	-2.371	*
Work Intl. Calls						
Faculty	18	.39				
Staff	22	.05	-.343	.018	-2.477	*

** statistically significant at the 99 percent confidence level
* statistically significant at the 95 percent confidence level
Chart 5.6 Factor Analysis Based on Profession

This suggests that faculty might be more engaged in utilizing VRS at work, compared to staff members. This finding was quite interesting because I assumed that staff members might be utilizing VRS more than faculty members do due to the nature of their work. In addition, the difference is significant at the 95 percent confidence level

regarding making international calls at work. However, the difference was small compared to other two items above.

5.2.2 Factor Analysis Based on Gender

I was curious to learn if any statistical significant differences exist in terms of gender. However, no differences were found. This suggests that gender may not play a significant role in determining how people utilize VRS.

5.2.3 Factor Analysis Based on Communication Method

Chart 5.7 shows that the difference in communication method is statistically significant in pairwise comparisons regarding respondents make outgoing calls and receiving incoming calls at home. The findings indicates that people who prefer to use sign only are more active users of VRS compared to those who prefer to use sign and speech together. This would support the contention that VRS is a preferred medium of access to relay services using American Sign Language. The findings suggest that how people communicate plays a role in the utilization of VRS.

Question	N	X	X diff	Sig. (2 tailed)	t	
Home Outgoing Calls						
Sign Only	24	3.00				
Sign/Speech	16	2.25	.750	.017	2.494	*
Work Incoming Calls						
Sign Only	24	1.88				
Sign/Speech	16	1.31	.563	.050	2.028	*
Home Incoming Calls						
Sign Only	24	2.38				
Sign/Speech	16	1.56	.813	.021	2.407	*

* statistically significant at the 95 percent confidence level

Chart 5.7 Factor Analysis Based on Communication Method

5.2.4 Factor Analysis Based on Age

As with gender, I found no statistical significant difference based on a difference in age groupings used in this study, however The N was very small.

5.3 Gratification Analysis of Text-based Relay Services and VRS

Whether respondents are satisfied with either text-based relay services or video relay services was also assessed. I decided to explore if respondents were satisfied with: 1) Typing speed (of text-based relay) ; 2) Sign quality (of VRS); 3) Access to Voicemail, 4) Access to automated voice messages; 5) Access for hearing callers; 6) Technical Support; 7) Equipment Set-up; 8) Attitude of Operator; and 9) Wait time to connect to the services (Please see Appendix A, Q.35-42 and Q.43-50.)

I found that many respondents rated the questions regarding access for voicemail; automated voice messages; hearing callers,; technical support; equipment set up as "not applicable". Due to the lack of valid responses (more than one third of the respondents), I could not conduct an independent t-test using SPSS for the items indicated above. Thus, I had to remove these from the analysis. I proceeded to analyze data related to; Typing speed (text-based relay only); Sign quality (VRS only); Attitude of Operator; and Wait time for connecting to the relay operator.

I followed the same analytical framework described in prior section of this report (a t-test for the difference in age group is not discussed in this section because N was too small) I calculated a mean, a mean difference, p-value, and t-score of each group using SPSS. The highlighted yellow cells indicate that a difference is statistically significant.

5.3.1 Gratification Analysis Based on Profession

Chart 5.8 shows that faculty members seem to be slightly more satisfied with the quality of text based relay services while staff members are more satisfied with VRS. This might be due to the level of confidence in written English The difference is small and is not statistically significant.

Question	N	X	X diff	Sig. (2 tailed)	t
Text Typing Speed					
Faculty	22	2.59			
Staff	17	2.53	.061	.855	.184
VRS Sign Quality					
Faculty	24	2.71			
Staff	19	2.89	-.186	.398	-.853
Text CA Attitude					
Faculty	22	2.59			
Staff	15	2.33	.258	.366	.917
VRS VI Attitude					
Faculty	22	2.82			
Staff	18	3.00	-.182	.427	-.803
Text Wait Time					
Faculty	23	2.48			
Staff	16	2.31	.166	.655	.451
VRS Wait Time					
Faculty	23	2.26			
Staff	18	2.61	-.350	.258	-1.147

Chart 5.8 Factor Analysis Based on Profession

5.3.2 Gratification Analysis Based on Gender

Chart 5.9 shows that females seem to be slightly more satisfied with the overall quality of services as compared to males on typing speed of text-based relay operators, sign quality of video relay services, attitudes of operators and wait time for accessing both text-based relay and video relay services. However, the difference was not statistically significant.

Question	N	X	X diff	Sig. (2 tailed)	t
Text Typing Speed					
Male	18	2.39			
Female	21	2.71	-.325	.328	-.992
VRS Sign Quality					
Male	20	2.65			
Female	23	2.91	-.263	.233	-1.211
Text CA Attitude					
Male	16	2.44			
Female	21	2.52	-.086	.761	-.307
VRS VI Attitude					
Male	18	2.67			
Female	22	3.09	-.424	.059	-1.949
Text Wait Time					
Male	17	2.18			
Female	22	2.59	-.414	.256	-1.154
VRS Wait Time					
Male	19	2.11			
Female	22	2.68	-.577	.058	-1.956

Chart 5.9 Gratification Analysis Based on Gender

5.3.3 Gratification Analysis Based on Communication Method

Chart 5.10 shows that people who communicate using both sign and speech together seem to be slightly more satisfied with the quality of relay services.

Question	N	X	X diff	Sig. (2 tailed)	t	
Text Typing Speed						
Sign Only	22	2.41				
Sign/Speech	17	2.76	-.356	.287	-1.081	
VRS Sign Quality						
Sign Only	24	2.71				
Sign/Speech	19	2.89	-.186	.398	-.853	
Text CA Attitude						
Sign Only	19	2.21				
Sign/Speech	18	2.78	-.567	.038	-2.162	*
VRS VI Attitude						
Sign Only	22	2.82				
Sign/Speech	18	3.00	-.182	.427	-.803	
Text Wait Time						
Sign Only	21	2.24				
Sign/Speech	18	2.61	-1.041	.305	-1.041	
VRS Wait Time						
Sign Only	22	2.36				
Sign/Speech	19	2.47	-.357	.723	-.357	

* statistically significant at the 95 percent confidence level

Chart 5.10 Gratification Analysis Based on Communication Method

The chart also shows that the difference in gratification regarding attitude of the operators for text-based relay is significant at the 95 percent confidence level between those who use sign only and sign and speech together.

5.4 Discussion of Data Analysis

In sum, the statistical significant differences between work and home use of VRS were found in incoming calls, conference calls, and equipment configuration. The differences in other items were not statistically significant based on pairwise t-test conducted utilizing SPSS. The findings regarding outgoing vs. incoming calls is consistent with statements in the policy paper presented by the National Council on Disability regarding access for hearing callers to deaf and hard of hearing callers. I found that a majority of respondents receive less incoming calls compared to making outgoing calls. Since the current telecommunications relay services (both text-based relay and Video Relay Services) lack a consistent uniform numbering scheme for incoming calls, there is a barrier for hearing callers to reach them.

In addition, a majority of respondents lack access to information services such as voicemail and interactive voice recording (or automated voice messages) even though these services should be more accessible due to the legal mandates of the Section 255. A majority of respondents indicated that they do not utilize information services; however, the difference in work and home use of conference calls was statistically significant at the 99 percent confidence level. This suggests that deaf and hard of hearing employees are utilizing conference call via VRS at work. This should be explored further to seek to improve accessibility to conference calls using VRS and other alternative access technologies. In an era of globalization, some deaf and hard of hearing individuals might

need to make international calls so that they can remain competitive in their career. At NTID, most individuals do not make international calls using VRS, but this is an area that should be explored further as demand grows.

The difference in the equipment configuration to access VRS was statistically significant at the 95 percent confidence level between at work and at home. Due to the nature of technical support available, the finding suggests that more respondents configure their equipment at home than at work. This suggests that many respondents might not know how to configure equipment on their own, which requires basic knowledge of networking to set up equipment for VRS. VRS providers might need to provide equipment that does not require technical configurations so that people are able to use it at the onset.

Regarding demographic factor analysis pertaining to work and home use, I found that the difference in profession, and communication method, plays a role in how people make outgoing calls and receive incoming calls. The difference in profession is somehow relevant to how people make and receive calls using VRS at work, while the difference in communication methods are relevant to how people make and receive calls using VRS at home. This area could be analyzed further to understand if there are any correlations between communication methods and professions regarding how individuals utilize VRS. On the other hand, the difference in gender and age did not have any impact on how people utilize VRS.

Regarding gratification in using text-based relay services and video relay services, faculty members indicated that they were more satisfied with text-based relay services while staff member indicated that they were more satisfied with video relay services.

Also, female respondents, and respondents who prefer to use sign and speech together indicated that they are more satisfied with the overall quality of relay services as compared to male respondents. Some individuals prefer text-based relay services with written English while others prefer VRS using sign language or their own voice using VCO.

The findings of the gratification analysis indicate that many deaf and hard of hearing do not have experience in utilizing information services - which is used extensively by the majority of hearing individuals - due to lack of accessibility or awareness. If deaf and hard of hearing individuals do not have any means of accessing information services, they still lack "functionally equivalent" access compared with the general population. When deaf and hard of hearing individuals are able to utilize these services and express their level of satisfaction at some point, it will be more feasible to measure" functionally equivalent" access.

The finding also suggests that the government should not generalize deaf and hard of hearing individuals into a single category, and make sure various relay options are available to serve a wide range of deaf and hard of hearing individuals. Generalizing deaf and hard-of-hearing individuals into a single category significantly limits their choice of relay services and comfort level in utilizing relay services.

6.0 Policy Recommendations

This section provides policy recommendations based on the findings from this survey analysis. First, I provide an overview of the role of the government and policy mechanisms that have been discussed throughout this paper, and explain what the government can do to achieve functionally equivalent telecommunication access. I

recommend the government implement the following strategies: 1) Regulations, 2) Information, and 3) Subsidies and Grants.

6.1 Overview of Role of Government and Policy Mechanism

Historically, deaf and hard of hearing individuals were barred from participating in every day activities through telecommunications because the government had not taken sufficient actions on their behalf until recently. When Congress enacted the Communication Act of 1934 that mandated telecommunications access to all the people of the United States, the existence of deaf and hard of hearing individuals was ignored. Until 1964, deaf and hard of hearing individuals did not have any means of communicating with others remotely using the telecommunications network, which were available for millions of Americans at that time.

Due to the significant transformation in disability policy in the United States, the government finally realized that what makes people with disabilities truly "disabled" is the social setting or environment that surrounds them. Government agencies started to adopt the social model of disability and became more involved in enhancing the quality of life and eliminating barriers for people with disabilities. The development of telecommunications relay services and video relay services is no exception. However, several obstacles to achieve functionally equivalent access for deaf and hard of hearing as well as hearing people still remain.

The survey identified the following key issues: (1) Disparities between outgoing calls and incoming calls exist, and access for hearing callers has not significantly improved; (2) Information services are not utilized as expected; (3) A significant

transition from text-based relay services to Video Relay Services is occurring; (4) Diverse usage patterns in a diverse population setting exist in the deaf community.

Bardach (2005) suggests 11 things the government can do to solve policy issues including: (1) Taxes, (2) Regulation, (3) Subsidies and Grants, (4) Providing Services, (5) Agency Budgets, (6) Information, (7) Modifying the Structure of Private Rights, (8) Modifying the Framework of Economic Activity, (9) Education and Consultation, (10) Financing and Contracting, and (11) Bureaucratic and Public Reform. I explored various policy options, and chose three items from Bardach's policy framework: Regulation, Subsidies and Grants, and Information. Finally, I provided policy recommendations following the four issues identified from the study.

6.2.1 Regulations

(1) Disparity between outgoing calls and incoming calls

The findings of the thesis demonstrated that deaf and hard of hearing individuals who participated in this study are still struggling to become accessible to hearing callers, and there is still a discrepancy between the volume of outgoing calls and incoming calls. Due to the lack of an uniform dialing numbering system that is associated with the North American Numbering Plan (NANP), deaf and hard of hearing people are isolated from the rest of mainstream society. On June 24, 2008, the FCC released a Report and Order implementing a new system for assigning 10-digit telephone numbers to VRS users by the end of 2008 (FCC, 2008). According to the FCC (2008), a neutral third-party administrator will be recruited to construct the database, and the selected administrator will operate and maintain the database to map the NANP 10-digit telephone numbers to VRS and other internet-based relay users. The FCC must make sure that this mechanism

of providing deaf and hard of hearing VRS users with a common phone number is feasible and accessible, so that hearing callers can reach them easily.

(2) Information Services

The survey results indicate that the Section 255 of the Telecommunications Act of 1996 regarding voicemail and automated voice message has been ineffective because most respondents indicated that they never use these services. Voicemail and automated voice messages (interactive voice recordings) are heavily utilized by hearing populations today; however, they remain grossly underutilized by deaf and hard of hearing callers.

The FCC should recognize this issue, and make sure that these information services are accessible. Currently, the government provides certification for telecommunications relay services providers to provide relay services in every state. In addition to the current certification system, the government should establish a certification system for information services. Since voicemail and automated voice messages are protected under Section 255 of the Telecommunications Act of 1996, the government should seek a new option to establish a certification system for these information services.

Voice over the Internet Protocol (Vo-IP) technologies are becoming another common tool for telecommunications in today's society and this becomes another concern because information services provided under Vo-IP are not guaranteed under the existing legal mandates. The government should regulate Vo-IP services and make sure these providers provide the same amount of accessibility that have been provided for existed telecommunications services. Otherwise, deaf and hard of hearing individuals will be left behind again.

(3) Transition to VRS from text-based relay services

More than 50% of the respondents do not use text-based relay services according to the survey result, and they have shifted toward VRS. However, VRS is still a relatively new format of relay services that began in 2002. Currently, TTYs are installed in major public facilities such as airports, service areas, governmental buildings, etc. However, only a few videophones or VRS capable computers have been installed in these locations. The government should recognize that many deaf and hard of hearing people prefer to use VRS as a relay option compared to text-based relay services, and extend the protections to Video Relay Services in the near future.

(4) Diverse Usage Patterns in the Deaf Community

The survey also indicated that a wide range of usage patterns and preferences exist in the deaf population. The government should not consider deaf and hard of hearing individuals in a simple category, and ensure that deaf and hard of hearing individuals have access to a wide range of telecommunications services that are available to hearing consumers.

6.2.2 Subsidies and Grants

(1) **Disparity between outgoing calls and incoming calls**

In order to implement a uniform numbering scheme, it costs money for private entities to implement the new program so that deaf and hard of hearing individuals would be more accessible to hearing callers. To provide an incentive to implement a uniform numbering scheme, the government should provide financial incentives to telecommunications carriers to make this transition in an efficient manner.

(2) **Information Services**

As the survey result indicates, information services are underutilized by deaf and hard of hearing people. My recommendation is to investigate emerging speech-to-text technologies that can provide access to information services. Several private companies have already provided speech to text technologies for voicemail, and this could be an area for potential growth to improve accessibility. The government should seek alternatives for access to information services so that deaf and hard of hearing individuals would not be left behind in this rapidly developing area in the telecommunications industry.

(3) **Transition to VRS from text-based relay services**

Currently, several VRS agencies provide either videophone or VRS capable computers to a few public facilities throughout the country. However, they are limited to communities with larger deaf populations. In order to facilitate smooth transition to VRS in many parts of the country, the FCC should consider providing subsidies or grants to build VRS kiosks or stations in public facilities with greater needs (i.e. major airports, train stations, hospitals, schools, or government buildings, etc.)

(4) **Diverse Usage Patterns in the Deaf Community**

Many universities and colleges receive subsidies and grants from government agencies such as NSF for enhancing their research capabilities and for improving the quality of education and classroom access. On the other hand, telecommunication relay services have not received much research and development compared to other access technologies. The FCC could establish a competitive grant program specifically for improving and enhancing functionally equivalent telecommunications access for deaf and hard of hearing individuals.

6.2.3 Information/Awareness

(1) **Disparity between outgoing calls and incoming calls**

One of the possible reasons for deaf and hard of hearing individuals being inaccessible to hearing callers could be due to lack of awareness by hearing callers. Currently, hearing callers need to have two pieces of information on hand when placing a call to deaf and hard of hearing individuals through relay services: a telephone number to reach an operator and a contact number (a proxy number) for each deaf and hard of hearing individual. Many hearing individuals do not realize they are required to submit two pieces of information to relay operators to reach deaf and hard of hearing callers.

In order to resolve this issue, telecommunications carriers should develop a centralized database of deaf and hard of hearing individuals by name, location, and their contact number. The database should be inter-operatable by different telecommunications carriers and relay services providers the same way that the centralized telephone number database is available for voice callers. In case hearing callers forget the contact number of deaf and hard of hearing individuals, they would be able to find their contact information through the centralized database.

(2) **Information Services**

According to Section 255, voicemail and interactive voice recordings should be accessible. However, it seems that many deaf and hard of hearing people are not aware of this fact, according to the survey results. It is possible that the lack of use by deaf and hard of hearing individuals is due to lack of awareness of the different options available to them. The FCC is currently providing some information and resources on the basic functions of telecommunication relay services, on their website.

However, this website provides little information on how deaf and hard of hearing individuals are able to access information services. In addition, hearing individuals do not know how to reach deaf and hard of hearing individuals via voicemail or other information services. The FCC should develop an improved strategy to inform deaf and hard of hearing relay users as well as hearing callers about a wide range of information services that are available to them. The website should contain not only basic information about relay services, but also cover the information services that are available to them.

(3) **Transition to VRS from text-based relay services**

Even though significant transition from text-based relay services to VRS is occurring, many deaf and hard of hearing people are not aware that VRS is only accessible via the Internet, not via landline like the traditional TTYs (Teletypewriters). In case of emergency or disasters that prevent them from accessing the Internet, the TTY continues to be the only lifeline that connects to the relay operators without routing through the Internet. The survey indicates that more than a half of the respondents do not use TTYs. In case of emergency or disasters, they would need to access to TTYs no matter what, so it is the government's responsibility to remind deaf and hard of hearing individuals about those relay options in case of emergency to protect their safety.

(4) **Diverse Usage Patterns in the Deaf Community**

As relay services become diverse, the usage patterns of deaf and hard of hearing individuals vary. This trend is a great advancement to achieve functionally equivalent access because deaf and hard of hearing people are able to choose the best communication methods to meet their needs. On the other hand, the survey result indicates that many respondents might not be aware of the different relay options that are

available to them. This could be due to overwhelming amount of information that deaf and hard of hearing people need to absorb regarding various providers. The government could encourage all relay service providers to simplify and provide that information in an accessible form (such as developing brochures or access guidelines made available on the Internet)

7.0 Conclusions and Limitations

This study discovered that obstacles for functionally equivalent access still exist. The study suggests that there are some things that the government can do to improve accessibility for deaf and hard of hearing people. Access to telecommunications is a civil right for everyone, so the government should continue improving functionally equivalent access for deaf and hard of hearing individuals.

A limitation is that to this study was conducted at the National Technical Institute for the Deaf, whose population of deaf and hard of hearing employees is quite unique. Thus, the finding of this study cannot be generalized to other deaf communities in the United States. In addition, it was more difficult to conduct a gratification analysis due to the lack of valid responses because I was unable to receive an adequate number of responses regarding relay service use. The survey was quite limited in this aspect.

References

The Americans with Disabilities Act of 1990. (Cover story). (1990, Summer). *American Rehabilitation*, Retrieved November 3, 2007, from Academic Search Elite database.

Bahr, S.J. (1992). Ease of Access to Telecommunications Relay Service. *44 Federal. Communications Law Journal 473*. Retrieved February 21, 2008, from LexisNexis Academic Database.

Bardach, E. (2005). *A practical guide for policy analysis: the eightfold path to more effective problem solving*. Washington, DC: CQ Press.

Baynton, D. C. (1996). *Forbidden signs*. Chicago: The University of Chicago Press.

Bowe, F. G. (1991). National survey on telephone services and products: The views of deaf and hard-of-hearing people. *Americans Annals of the Deaf, 136*(3), 278-83.

Bowe, F. G. (1993). Access to the information age: Fundamental decisions in telecommunications policy. *Policy Studies Journal, 21*(4), 765. Retrieved February 21, 2008, from Research Library database.

Bowe, F. G. (2002). Deaf and hard of hearing Americans' instant messaging and e-mail use: A national survey. *American Annals of the Deaf, 147*(4), 6-10. Retrieved February 21, 2008, from Academic Search Elite database.

Bowe, F. G. (2005). *Two-way technologies: A history of the struggle to communicate*. Retrieved February 17, 2008, from http://www.people.hofstra.edu/faculty/frank_g_bowe

Conover, W. J. (1971). *Practical nonparametric statistics*. New York, NY: John Wiley & Sons, Inc.

Corker, M. (1998). *Deaf and disabled, or deafness disabled?: Towards a human rights perspective*. Buckingham, UK/Philadelphia, PA: Open University Press.

FCC. (June, 2008). *Commission releases sources sought announcement seeking contractor to build and operate centralized database for internet based telecommunications relay service numbering system*. Retrieved July 29, 2008, from http://fjallfoss.fcc.gov/edocs_public/attachmatch/DA-08-1483A1.pdf

FCC. (June, 2008). *FCC adopts telephone numbering system and E-011 requirement for providers of internet based telecommunications relay services*. Retrieved June 22, 2008, from http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-282888A1.pdf

FCC. (2008). *TRS Mandatory Minimum Standards, 47 U.S.C. § 225*. Retrieved February 22, 2008, from http://www.fcc.gov/cgb/dro/4regs.html

FCC. (2008). *Telecommunications Relay Services*. Retrieved July 10, 2008, from http://www.fcc.gov/cgb/consumerfacts/trs.html

FCC. (2008). *Section 255 telecommunications access for people with disabilities*. Retrieved February 22, 2008, from http://www.fcc.gov/cgb/consumerfacts/section255.html

FCC (2006, May 9). *Declaratory ruling and further notice of proposed rulemaking*. Retrieved February 22, 2008, from the Federal Communications Commission Website: http://www.fcc.gov/omd/pra/docs/3060-1091/3060-1091-04.doc.

Gallaudet Research Institute (2005). *Current Estimates (2004): How many deaf people are there in the U.S.?*. Retrieved February 22, 2008, from http://gri.gallaudet.edu/Demographics/deaf-US.php

Harris, J. & Bamford. C. (2001). The uphill struggle: Services for Deaf and hard of hearing people – issue of equality, participation and access. *Disability & Society, 16*(7), 969-979. Retrieved March 26, 2008, from EBSCOhost EJS database.

Hurst, R. (2003, June 3). The international disability rights movement and the ICF. *Disability & Rehabilitation*, 25(11.12), 572. Retrieved March 23, 2008, from Academic Search Elite database.

Ingram, D. (2006, April). Antidiscrimination, Welfare, and Democracy: Toward a Discourse-Ethical Understanding of Disability Law. *Social Theory & Practice*, *32*(2), 213-248. Retrieved October 21, 2007, from Academic Search Elite database.

Kanayama, T. (2003). Leaving it up to the industry: People with disabilities and the telecommunications act of 1996. *The Information Society, 19*(2), 185-194. Retrieved February 21, 2008, from EBSCOhost EJS Database.

Kaplan, D. (2007). The definition of disability. Retrieved October 21, 2007, from the Center for an Accessibly Society Web site: http://www.accessiblesociety.org/topics/demographics-identity/dkaplanpaper.htm

Lane, H. (1995). Construction of deafness, *Disability & Society*, *10*(2), 171-189.

Lang, H. G. (2001). *From dream to reality: the National Technical Institute for the Deaf: a college of Rochester Institute of Technology*. Rochester, NY: Rochester Institute of Technology.

Lang, G. H. (2000). *A phone of our own: the deaf insurrection against Ma Bell*. Washington, DC: Gallaudet University Press.

Lange, A. (2003). *TDI Resource Guide*, 27-28. Retrieved February 17, 2008, from http://www.tdi-online.org/tdi/ResourceGuidePDF/bluepages2004p27-28.pdf

Middleton, R., Rollins, C., & Harley, D. (1999, April). The Historical and Political Context of the Civil Rights of Persons with Disabilities: A Multicultural Perspective for Counselors. *Journal of Multicultural Counseling & Development, 27*(2), 105. Retrieved May 1, 2008, from Academic Search Elite database.

Mitra, S. (2006, Spring). The capability approach and disability. *Journal of Disability Policy Studies*, 16(4), 236-247. Retrieved October 20, 2007, from Academic Search Elite Database.

National Association of the Deaf. (2000). *Legal rights: the guide for deaf and hard of hearing people* (5th ed.). Washington, D.C.: Gallaudet University Press.

National Council on Disability .(2006). *The need for federal legislation and regulation prohibiting telecommunications and information service discrimination*. Retrieved March 13, 2008, from http://www.ncd.gov/newsroom/publications/2006/pdf/discrimination.pdf.

National Technical Institute for the Deaf. (2008). *NTID FY 2007 Annual Report*. Retrieved, May 1, 2008, from http://www.ntid.rit.edu/media/annual_report2007.pdf

NECA (2008). *State Internet & Video Reports*. Retrieved May 1, 2008, from http://www.neca.org/source/NECA_Resources_4438.asp?print

Percy, S. L. (1989). *Disability, civil rights, and public policy: The politics of implementation*. Tuscaloosa, AL: The University of Alabama Press.

Power, M. R., Power, D. & Horstmanshof, L. (2007). Deaf people communicating via SMS, TTY, relay service, fax and computers in Australia. *Journal of Deaf Studies and Deaf Education, 12*(1), 80-92.

Robitaille, S. (2002). New Telecom Connections for the Deaf. *Business Week Online,* Retrieved May 6, 2007, from the Academic Search Elite database.

Rosen, J. (2007, September). Calling for consumer directed and inclusively designed technology. *Policy & Practice, 65*(3), 14-17. Retrieved February 17, 2008, from Research Library database.

Samaha, A. M. (2007). What good is the social model of disability? *The University of Chicago Law Review, 74*(4), 1251-1308. Retrieved April 7, 2008, from ABI/INFORM Global database.

Schriner, K. & Scotch R. K. (2003). The ADA and the meaning of disability. In L. H. Krieger (Ed.), *Backslash against the ADA* (p. 164-188). Ann Arbor, MI: The University of Michigan Press.

Scotch, R. K. (2001). *From good will to civil rights: Transforming federal disability policy* (2nd ed.). Philadelphia: Temple University Press.

SHHH. (1996). *People with hearing loss and the workplace: A guide for employers to comply with the Americans with disabilities act* (2nd ed.). Bethesda, MD: Self Help for Hard-of-hearing People.

Stein, M. (2007, February). Disability Human Rights. *California Law Review*, 95(1), 75-121. Retrieved October 21, 2007, from Academic Search Elite database.

Strauss, K. P. (2006). *A new civil right: Telecommunications equality for deaf and hard of hearing Americans.* Washington, D.C.: Gallaudet University Press.

Switzer, J. V. (2003). *Disabled rights: American disability policy and the fight for equality*. Washington, D.C.: Georgetown University Press.

The U.S. Census Bureau. (2006). *Americans with disabilities: 2002*. Retrieved April 17, 2007, from http://www.census.gov/prod/2006pubs/p70-107.pdf.

The U.S. Office of Management and Budget. (2007). *Detailed Information on the telecommunications relay service assessment.* Retrieved from Expectmore.gov website, http://www.whitehouse.gov/omb/expectmore/detail/10003111.2006.html.

Appendices

Appendix A: Barriers for Telecommunication Accessibility and Needs Assessment of Video Relay Services (VRS) Survey

Barriers for Telecommunication Accessibility and Needs Assessment of Video Relay Services (VRS)

Instructions:

Thank you very much for taking your time to participate in this survey. The aim of this study is to investigate how Video Relay Services(VRS) are utilized among deaf and hard-of-hearing professionals at NTID/RIT. The survey should only take 10-15 minutes. There are two sets of questions. The first set of questions will ask you how you utlize VRS at work and at home. Question 6-19 will ask you how you utilize VRS at work, and question 20-33 will ask you how you utilize VRS at home.

The second set of questions ask you to compare your experience with traditional text-based relay services (TTY relay, Internet- based text relay etc) and VRS. Question 34-40 will ask you how satisfied you are with Text-based Relay Services, and Question 41-47 will ask you how satisfied you are with VRS.

Please fill in a space to answer Question 48 to list the benefits/limitations, or any experiences using VRS you would like to share.

Please remember that a direct VP-to-VP (peer to peer) connection is not a VRS call, and is not addressed in this survey.

(Definitions)

Video Relay Services (VRS) are telecommunication services that allow deaf and hard of hearing individuals to communicate over the phone with hearing people in real-time, using a sign language interpreter.

Text-based Relay Services are telecommunication services that allow deaf and hard of hearing individuals to communicate over the phone with hearing people in real-time, using a TTY, pager, mobile phones, laptop or desktop computers.

Voice Carry Over (VCO) is a federally mandated relay service that was designed for individuals who are deaf or hard-of-hearing but are able to speak and would prefer to use their own voices to communicate.

Demographic questions

Q1. Are you Faculty or Staff?

1. Faculty
2. Staff

Q2. Are you Deaf or Hard of Hearing?

1. Deaf
2. Hard of Hearing

Q3. Are you Male or Female?

1. Male
2. Female

Q4. How do you communicate mostly?

1. Sign
2. Speech

3. Sign and Speech together

Q5. What is your age?

1. 18-29
2. 30-39
3. 40-49
4. 50-59
5. 60 or older

Q6. What is the highest level of education you have completed?

1. High School/GED
2. 2-year College Degree (Associates)
3. 4-year College Degree (BA, BS)
4. Master's Degree
5. Doctoral Degree
6. Professional Degree (MD, JD, etc)

VRS/Text-based Relay Services Use at Work

Q7. Do you have stand-alone videophone equipment (Sorenson VP-200, VP-100, Ojo, D-Link i2eye, etc.) at WORK?

1. Yes
2. No

Q8. Do you have a VRS capable computer with a webcam (Sorenson Envision SL, Viable Vision, i711 VRS, iSight/iChat for HOVRS, etc.) at WORK?

1. Yes
2. No

Q9. Do you use a TTY at WORK?

1. Yes
2. No

Frequency of VRS/Text-based Relay Services Use at WORK

Please select a response using the scale below:

1. Always (everyday)
2. Often (a few times a week)
3. Sometimes (once a week or less)
4. Rarely (once a month or less)
5. Never

Q10. How often do you make a VRS call (outgoing) at WORK?

Q11. How often do you receive a VRS call (incoming) at WORK?

Q12. How often do you use VRS to access your voicemail if any at WORK?

Q13. How often do you use VRS to access automated voice messages at WORK?

Q14. How often do you use VRS to access to a conference call (3-way or more) at WORK?

Q15. How often do you use VRS to initiate an international call (including Canada and Mexico) at WORK?

Q16. How often do you use your pager or wireless devices (Blackberry, Sidekick or other wireless devices, etc.) to receive messages through VRS at WORK?

Q17. How often do you configure VRS equipment by yourself at WORK?

Q18. How often do you use text-based relay services (TTY relay, Internet-based text relay, etc.) at WORK?

Q19. How often do you use Voice Carry Over (VCO) while using VRS at WORK?

Q20. How often do you use Voice Carry Over (VCO) while using text-based relay services (TTY relay, Internet-based text relay, etc.) at WORK?

VRS/Text-based Relay Services Use at Home

Q21. Do you have stand-alone videophone equipment (Sorenson VP-200, VP-100, Ojo, D-Link i2eye, etc.) at HOME?

1. Yes
2. No

Q22. Do you have a VRS capable computer with a webcam (Sorenson Envision SL, Viable Vision, i711 VRS, iSight/iChat for HOVRS, etc.) at HOME?

1. Yes
2. No

Q23. Do you use a TTY at HOME?

1. Yes
2. No

Frequency of VRS/Text-based Relay Services Use at HOME

Please select a response using the scale below:

1. Always (everyday)
2. Often (a few times a week)
3. Sometimes (once a week or less)
4. Rarely (once a month or less)
5. Never

Q24. How often do you make a VRS call (outgoing) at HOME?

Q25. How often do you receive a VRS call (incoming) at HOME?

Q26. How often do you use VRS to access your voicemail if any at HOME?

Q27. How often do you use VRS to access automated voice messages at HOME?

Q28. How often do you use VRS to access to a conference call (3-way or more) at HOME?

Q29. How often do you use VRS to initiate an international call (including Canada and Mexico) at HOME?

Q30. How often do you use your pager or wireless devices (Blackberry, Sidekick or other wireless devices, etc.) to receive messages through VRS at HOME?

Q31. How often do you configure VRS equipment by yourself at HOME?

Q32. How often do you use text-based relay services (TTY relay, Internet-based text relay, etc.) at HOME?

Q33. How often do you use Voice Carry Over (VCO) while using VRS at HOME?

Q34. How often do you use Voice Carry Over (VCO) while using text-based relay services (TTY relay, Internet-based text relay, etc.) at HOME?

How satisfied are you with current telecommunications relay services (Text-based Relay Services)?

Please select a response using the scale below that better describes how satisfied you are with each item

1. Very satisfied
2. Satisfied
3. Neither satisfied nor dissatisfied (Neutral)
4. Dissatisfied
5. Very dissatisfied

Q35. Typing speed of text-based relay calls

Q36. Access to voicemail messages if any

Q37. Access to automated prompt messages (recorded messages)

Q38. Access for hearing callers to reach you

Q39. Technical support from traditional telecommunication carriers for accessing text based relay services (TTY relay, Internet-based text relay etc)

Q40. Setting up equipment for accessing text-based relay services (TTY relay, Internet- based text relay etc)

Q41. Attitude of Communication Assistants (Operators for text-based relay services)

Q42. Wait time for connecting to Communication Assistants (Operators for text-based relay services)

How satisfied are you with Video Relay Services (VRS)?

Please select a response using the scale below that better describes how satisfied you are with each item

1. Very satisfied
2. Satisfied
3. Neither satisfied nor dissatisfied (Neutral)
4. Dissatisfied
5. Very dissatisfied

Q.43 Sign quality of interpreters for VRS calls

Q44. Access to voicemail messages if any

Q45. Access to automated prompt messages (recorded messages)

Q46. Access for hearing callers to reach you

Q47. Technical support from VRS providers for accessing VRS

Q48. Setting up equipment for accessing VRS

Q49. Attitude of Video Interpreters (VI)

Q50. Wait time for connecting to Video Interpreters (VI)

Q51. Please use the space below to list the benefits/limitations, or any experiences using VRS.

Thank you very much for your participation in the survey

Appendix B: Demographic Information of the Sample Population

	N	%
Staff	24	55.8
Faculty	19	44.2
Total	43	100.0

	N	%
Male	20	46.5
Female	23	53.5
Total	43	100.0

	N	%
Deaf	37	86.0
Hard of Hearing	6	14.0
Total	43	100.0

	N	%
Sign only	24	55.8
Sign and Speech together	19	44.2
Total	43	100.0

	N	%
1 18 to 29	4	9.3
2 30 to 39	11	25.6
3 40 to 49	15	34.9
4 50 to 59	12	27.9
5 60 or older	1	2.3
Total	43	100.0

	Frequency	Percent
Bachelor's Degree	5	11.6
Master's Degree	30	69.8
Doctorate Degree	7	16.3
Professional Degree	1	2.3
Total	43	100.0

Appendix C: Summary Chart of Work Home Analysis

Outgoing calls	N	Always	Often	Sometimes	Rarely	Never
Work	43	9	17	13	4	0
Home	43	10	12	15	3	3

Incoming calls	N	Always	Often	Sometimes	Rarely	Never
Work	43	1	6	17	16	3
Home	43	5	7	16	10	5

Voicemail	N	Always	Often	Sometimes	Rarely	Never
Work	43	2	1	2	5	33
Home	43	1	1	1	2	38

Auto. Message	N	Always	Often	Sometimes	Rarely	Never
Work	43	1	0	4	5	33
Home	43	1	1	0	2	39

Conf. Call	N	Always	Often	Sometimes	Rarely	Never
Work	*42	0	0	3	10	29
Home	43	0	0	2	1	40

* 1 missing value

Intl. Call	N	Always	Often	Sometimes	Rarely	Never
Work	43	0	0	1	6	36
Home	43	0	0	1	5	37

Wireless Msgs	N	Always	Often	Sometimes	Rarely	Never
Work	43	4	1	3	6	29
Home	43	5	3	2	3	30

Configuration	N	Always	Often	Sometimes	Rarely	Never
Work	43	1	0	7	10	25
Home	43	1	3	7	13	19

Text-based Relay	N	Always	Often	Sometimes	Rarely	Never
Work	43	3	5	9	14	12
Home	43	3	7	7	10	16

VCO via VRS	N	Always	Often	Sometimes	Rarely	Never
Work	43	3	1	1	2	36
Home	43	2	1	4	1	35

VCO via Text-based Relay	N	Always	Often	Sometimes	Rarely	Never
Work	43	1	1	0	1	40
Home	42	1	1	0	1	39

Appendix D: Summary Chart of Gratification Analysis

Typing Speed	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied	Does not apply
Text-based relay	43	6	17	11	3	2	4

Sign Quality	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied
VRS	43	4	29	7	3	0

Access to VM	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied	Does not apply
Text-based relay	43	0	3	2	1	1	36
VRS	43	0	6	0	0	0	37

Access to IVR	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied	Does not apply
Text-based relay	43	0	5	1	5	3	29
VRS	43	3	8	0	1	0	31

Hearing Caller	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied	Does not apply
Text-based relay	43	1	10	10	9	2	11
VRS	43	4	12	8	3	2	14

Technical Support	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied	Does not apply
Text-based relay	43	0	7	12	2	1	21
VRS	42*	2	21	7	1	2	9

* 1 missing value

Setting up equipment	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied	Does not apply
Text-based relay	43	3	12	9	3	0	16
VRS	43	4	17	10	1	0	11

Attitude of Operator	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied	Does not apply
Text-based relay	43	3	17	12	5	0	6
VRS	43	7	23	9	1	0	3

Wait time	N	Very satisfied	Satisfied	Neither	Dissatisfied	Very dissatisfied	Does not apply
Text-based relay	43	4	19	9	3	4	4
VRS	43	2	22	11	3	3	2

Appendix E: Work Home Analysis

Activity	N	X	X diff	Sig. (2 tailed)	t	
Outgoing calls						
Work	40	2.73				
Home	40	2.70	.025	.860	.177	
Incoming calls						
Work	40	1.65				
Home	40	2.05	-.400	.016	-2.511	*
Voicemail						
Work	40	.48				
Home	40	.28	.200	.103	1.669	
Auto. Message						
Work	40	.40				
Home	40	.23	.175	.213	1.267	
Conf. Calls						
Work	39*	.41				
Home	39*	.08	.333	.001	3.606	**
Intl. Calls						
Work	40	.20				
Home	40	.18	.025	.711	.374	
Wireless Dev.						
Work	40	.70				
Home	40	.90	-.200	.198	-1.309	
Config Eqpt.						
Work	40	.68				
Home	40	.98	-.300	.050	-2.020	*
Text relay use						
Work	40	1.35				
Home	40	1.40	-.050	.762	-.305	
VCO via VRS						
Work	40	.48				
Home	40	.50	-.025	.711	-.374	
VCO via Text						
Work	39*	.21				
Home	39*	.21	.000	1.000	.000	

APPENDIX F: Faculty Staff Analysis

Question	N	X	X diff	Sig. (2 tailed)	t	
Work Outgoing Calls						
Faculty	18	3.22				
Staff	22	2.32	-.904	.001	-3.447	**
Home Outgoing Calls						
Faculty	18	3.00				
Staff	22	2.45	-.545	.084	-1.777	
Work Incoming Calls						
Faculty	18	2.00				
Staff	22	1.36	-.636	.023	-2.371	*
Home Incoming Calls						
Faculty	18	2.00				
Staff	22	2.09	.091	.800	.255	
Work Voicemail						
Faculty	18	.67				
Staff	22	.32	-.348	.308	-1.033	
Home Voicemail						
Faculty	18	.28				
Staff	22	.27	-.005	.985	-.019	
Work Auto. Message						
Faculty	18	.56				
Staff	22	.27	-.283	.313	-1.022	
Home Auto. Message						
Faculty	18	.22				
Staff	22	.23	.005	.984	.020	
Work Conf. Calls						
Faculty	18	.56				
Staff	21	.29	-.270	.191	-1.331	
Home Conf. Calls						
Faculty	18	.00				
Staff	22	.23	.227	.124	1.572	
Work Intl. Calls						
Faculty	18	.39				
Staff	22	.05	-.343	.018	-2.477	*
Home Intl. Calls						
Faculty	18	.22				
Staff	22	.14	-.086	.552	-.600	
Work Wireless Dev.						
Faculty	18	.78				
Staff	22	.64	-.141	.730	-.348	
Home Wireless Dev.						
Faculty	18	.94				
Staff	22	.86	-.081	.866	-.169	
Work Config Eqpt.						
Faculty	18	.94				
Staff	22	.45	-.490	.103	-1.669	
Home Config Eqpt.						
Faculty	18	1.00				
Staff	22	.95	-.045	.896	-.131	

Question	N	X	X diff	Sig. (2 tailed)	t
Work Txt Relay					
Faculty	18	1.22			
Staff	22	1.45	.232	.566	.579
Home Txt Relay					
Faculty	18	1.39			
Staff	22	1.41	.020	.963	.047
Work VCO VRS					
Faculty	18	.61			
Staff	22	.36	-.247	.515	-.657
Home VCO VRS					
Faculty	18	.67			
Staff	22	.36	-.303	.397	-.856
Work VCO Text					
Faculty	18	.22			
Staff	22	.18	-.040	.875	-.159
Home VCO Text					
Faculty	18	.22			
Staff	21	.19	-.032	.904	-.122

Appendix G: Gender Analysis

Question	N	X	X diff	Sig. (2 tailed)	t
Work Outgoing Calls					
Male	18	2.61			
Female	22	2.82	-.207	.492	-.693
Home Outgoing Calls					
Male	18	2.83			
Female	22	2.59	.242	.449	.765
Work Incoming Calls					
Male	18	1.56			
Female	22	1.73	-.172	.552	-.600
Home Incoming Calls					
Male	18	1.83			
Female	22	2.23	-.394	.269	-1.122
Work Voicemail					
Male	18	.50			
Female	22	.45	.045	.895	.133
Home Voicemail					
Male	18	.11			
Female	22	.41	-.298	.274	-1.110
Work Auto. Message					
Male	18	.39			
Female	22	.41	-.020	.943	-.072
Home Auto. Message					
Male	18	.00			
Female	22	.41	-.409	.109	-1.643
Work Conf. Calls					
Male	17	.29			
Female	22	.50	-.206	.324	-1.000
Home Conf. Calls					
Male	18	.11			
Female	22	.14	-.025	.866	-.169
Work Intl. Calls					
Male	18	.11			
Female	22	.27	-.162	.279	-1.574
Home Intl. Calls					
Male	18	.17			
Female	22	.18	-.015	.917	-.105
Work Wireless Dev.					
Male	18	.50			
Female	22	.86	-.364	.373	-.902
Home Wireless Dev.					
Male	18	.50			
Female	22	1.23	-.727	.124	-1.574
Work Config Eqpt.					
Male	18	.94			
Female	22	.45	.490	.103	1.669
Home Config Eqpt.					
Male	18	1.06			
Female	22	.91	.146	.674	.425

Question	N	X	X diff	Sig. (2 tailed)	t
Work Txt Relay					
Male	18	1.28			
Female	22	1.41	-.131	.746	-.326
Home Txt Relay					
Male	18	1.28			
Female	22	1.50	-.222	.607	-.518
Work VCO VRS					
Male	18	.56			
Female	22	.41	.146	.701	.387
Home VCO VRS					
Male	18	.61			
Female	22	.41	.202	.397	.568
Work VCO Text					
Male	18	.22			
Female	22	.18	.040	.573	.159
Home VCO Text					
Male	17	.29			
Female	22	.14	.158	.904	.605

Appendix H: Communication Analysis

Question	N	X	X diff	Sig. (2 tailed)	t	
Work Outgoing Calls						
Sign Only	24	2.92				
Sign/Speech	16	2.44	.479	.113	1.624	
Home Outgoing Calls						
Sign Only	24	3.00				
Sign/Speech	16	2.25	.750	.017	2.494	*
Work Incoming Calls						
Sign Only	24	1.88				
Sign/Speech	16	1.31	.563	.050	2.028	*
Home Incoming Calls						
Sign Only	24	2.38				
Sign/Speech	16	1.56	.813	.021	2.407	*
Work Voicemail						
Sign Only	24	.63				
Sign/Speech	16	.25	.375	.280	1.097	
Home Voicemail						
Sign Only	24	.38				
Sign/Speech	16	.13	.250	.367	.913	
Work Auto. Message						
Sign Only	24	.58				
Sign/Speech	16	.13	.458	.104	1.667	
Home Auto. Message						
Sign Only	24	.38				
Sign/Speech	16	.00	.375	.149	1.474	
Work Conf. Calls						
Sign Only	23	.43				
Sign/Speech	16	.38	.060	.778	.285	
Home Conf. Calls						
Sign Only	24	.13				
Sign/Speech	16	.13	.000	1.000	.000	
Work Intl. Calls						
Sign Only	24	.29				
Sign/Speech	16	.06	.229	.128	1.558	
Home Intl. Calls						
Sign Only	24	.25				
Sign/Speech	16	.06	.188	.197	1.313	
Work Wireless Dev.						
Sign Only	24	.92				
Sign/Speech	16	.38	.542	.188	1.340	
Home Wireless Dev.						
Sign Only	24	1.25				
Sign/Speech	16	.38	.875	.067	1.889	
Work Config Eqpt.						
Sign Only	24	.75				
Sign/Speech	16	.56	.188	.545	.610	
Home Config Eqpt.						
Sign Only	24	1.04				
Sign/Speech	16	.88	.167	.637	.476	

Question	N	X	X diff	Sig. (2 tailed)	t
Work Txt Relay					
Sign Only	24	1.42			
Sign/Speech	16	1.25	.167	.685	.408
Home Txt Relay					
Sign Only	24	1.46			
Sign/Speech	16	1.31	.146	.740	.334
Work VCO VRS					
Sign Only	24	.29			
Sign/Speech	16	.75	-.458	.232	-1.214
Home VCO VRS					
Sign Only	24	.25			
Sign/Speech	16	.88	-.625	.081	-1.795
Work VCO Text					
Sign Only	24	.21			
Sign/Speech	16	.19	.021	.936	.081
Home VCO Text					
Sign Only	23	.17			
Sign/Speech	16	.25	-.076	.775	-.288

Appendix H: Age Analysis

Question	N	X	X diff	Sig. (2 tailed)	t
Work Outgoing Calls					
30-39	10	2.90			
50-59	11	2.36	.536	.216	1.281
Home Outgoing Calls					
30-39	10	2.80			
50-59	11	2.45	.345	.493	.699
Work Incoming Calls					
30-39	10	1.60			
50-59	11	1.55	.055	.890	.140
Home Incoming Calls					
30-39	10	2.20			
50-59	11	2.00	.200	.673	.429
Work Voicemail					
30-39	10	.70			
50-59	11	.09	.609	.201	1.326
Home Voicemail					
30-39	10	.60			
50-59	11	.09	.509	.237	1.221
Work Auto. Message					
30-39	10	.30			
50-59	11	.00	.300	.156	1.478
Home Auto. Message					
30-39	10	.40			
50-59	11	.09	.309	.440	.788
Work Conf. Calls					
30-39	9	.56			
50-59	11	.45	.101	.754	.319
Home Conf. Calls					
30-39	10	.20			
50-59	11	.18	.018	.947	.067
Work Intl. Calls					
30-39	10	.20			
50-59	11	.00	.200	.131	1.577
Home Intl. Calls					
30-39	10	.10			
50-59	11	.09	.009	.947	.067
Work Wireless Dev.					
30-39	10	.30			
50-59	11	.55	-.245	.579	-.564
Home Wireless Dev.					
30-39	10	1.00			
50-59	11	.91	.091	.894	.135
Work Config Eqpt.					
30-39	10	.10			
50-59	11	.45	-.355	.216	-1.281
Home Config Eqpt.					
30-39	10	.80			
50-59	11	.45	.345	.404	.853

Question	N	X	X diff	Sig. (2 tailed)	t
Work Txt Relay					
30-39	10	1.10			
50-59	11	1.36	-.264	.621	-.502
Home Txt Relay					
30-39	10	1.00			
50-59	11	1.27	-.273	.637	-.480
Work VCO VRS					
30-39	10	.90			
50-59	11	.00	.900	.088	1.799
Home VCO VRS					
30-39	10	.90			
50-59	11	.00	.900	.064	1.964
Work VCO Text					
30-39	10	.00			
50-59	11	.09	.900	.353	-.951
Home VCO Text					
30-39	9	.00			
50-59	11	.00	-.091	N/A	N/A