Relying on Sight as the Primary Sense: Employing Deaf Students in STEM and Design Fields

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Abstract

The university of interest operates an R&D center that encourages students and faculty to develop and test prototypes of devices to benefit individuals with diverse abilities. During the 2017-18 academic year, the R&D center hired fifteen deaf students employees in STEM and design fields to work on a suite of projects that investigate, evaluate and report on the most effective and efficient use of innovative access and inclusive technologies. Numerous prototypes directly resulted from the creative work of deaf students which was thoroughly vetted by subject matter experts, many of whom are deaf.

The Americans with Disabilities Act (ADA) and Section 501 of the Rehabilitation Act require employers to make reasonable accommodations for deaf employees. This paper describes how an R&D center focusing on accessibility for deaf part-time and full-time co-op employees, provides students the inclusive opportunity to experience the same equal benefits and privileges of being in a "hearing" employment.

Per focus group interviews of university student employees, the research team analyzed the responses of the interviewees and identified patterns. Descriptions of students' reflections of their work experiences will be presented, along with the discovery of themes prevalent to the characteristics of a good employer abiding the ADA and Section 501.

Based on the review of the literature and preliminary research findings noted, an employment guideline for employers hiring Deaf and Hard of Hearing (DHH) employees will be developed and disseminated. It will include, but not be limited to, effective ways to communicate between DHH employees and their hearing co-workers, different ways to overcome cultural differences, and ways to become a quality advocate of co-workers.

Introduction

At the university of interest, their highest priority is to assist their Deaf and Hard of Hearing (DHH) graduates with the progress of employment. There is a report revealing that DHH alumni with bachelor's degrees or higher earn about 60% more on the average than students who left university without a degree [1]. Also, DHH alumni's dependency on federal income support programs such as Supplemental Security Income (SSI) or Social Security Disability Insurance (SSDI) decreased [2]. DHH alumni employed in STEM fields earn 31% more than non-STEM fields [3]. These three pieces of evidence show DHH students graduating from the university results in major economic benefits for them.

However, DHH alumni with bachelor's degrees or higher in their work career show they have significantly less movement into management level positions compared to hearing counterparts with similar degrees. In their career, hearing alumni were 3.2 times more likely to be promoted to mid-management level compared to DHH alumni, 5.7 times more likely to senior manager and 7.3 times more likely to owner or entrepreneur [4].

In one book's chapter, the author stated the primary reasons for DHH alumni's limited ability to move up into management level position was due to DHH alumni experiences with "difficulty in receiving incidental information" and possessing communication skills which is highly expected and demanded in management positions [5].

To address the career mobility challenge, the university of interest strongly supports the idea of providing an R&D center on campus where DHH faculty lead DHH student employees to develop and test prototypes of devices to benefit individuals with diverse abilities. One of the center's goals is to prepare DHH students to secure a job and work after graduation. During the 2017-18 academic year (fall 2017 and spring 2018), the R&D center hired fifteen DHH student employees in STEM and design fields to work on a suite of projects.

This paper discusses their experience being employed in a unique R&D center providing linguistic and cultural support not found anywhere else. Also, this study assesses how an R&D center focusing on accessibility, gives DHH student employees the opportunity to experience equal benefits and privileges of hearing employment. Students' involvement in projects and their employment perceptions and experiences will be covered. Such findings should prompt further research to build evidence on the positive experiences of being DHH from an employer's standpoint.

The research question: will DHH student employees working in a deaf-centric environment (lead by DHH faculty) boost DHH students' change of leading in a productive workplace after graduation?

Method

The IRB-approved study has the following aims:

The first specific aim is to assess DHH student employment and their work experience by analyzing the responses of the interviewees to identify common themes, such as specific accommodations for employers to provide. DHH students would appreciate employers providing accommodations that would result in several equal benefits and privileges.

The second specific aim is to assess DHH student employment by conducting semi-structured focus group concerning the student employee's work experience and their working relationship with the employer. DHH student employment would report it is beneficial for them to work with a deaf faculty-led student-centric organization.

Based on first and second specific aims, it will allow DHH student employees to be on much closer equal baseline with their hearing peers.

Background and Projects

Despite recent improvements in the ability of DHH students to access information through the use or adaptation of technologies such as the Internet, mobile devices, text messaging, and videophones, these students still do not yet experience full access to information in

postsecondary education that is equal to that of their hearing peers. Many existing and developing technologies have significant potential to serve as effective "access technologies" for DHH people.

Access technologies refer to technologies or devices that can be utilized by DHH students to assist them in acquiring or sharing information, communicating, or otherwise participating in educational opportunities, including classroom, online learning, and laboratory experiences, as well as educational experiences taking place outside of the classroom. To address the unique challenges of utilizing or adapting new technologies for use in postsecondary educational settings, Rochester Institute of Technology (RIT) through its National Technical Institute for the Deaf (NTID) established the Center on Access Technology in March 2006 [6].

NTID is an internationally recognized leader in providing postsecondary education to DHH students. Located in Rochester, New York, NTID is one of the nine colleges of RIT. Its mission is "to provide deaf and hard-of-hearing students with outstanding state-of-the-art technical and professional education programs, complemented by a strong arts and sciences curriculum that prepare them to live and work in the mainstream of a rapidly changing global community and enhance their lifelong learning [7]." At RIT, more than 1,100 DHH students study, live, work, and socialize daily with 16,000 hearing peers. Students have the opportunity to participate in more than 20 accredited degree programs at RIT and earn bachelor's or master's degrees in more than 200 programs offered in RIT's colleges [8]. The RIT campus was the logical location for the Center on Access Technology. Here, the R&D center is in close proximity to more than 1,100 mainstreamed DHH students, and over 100 DHH faculty and staff. This places the R&D center in a unique position to study first-hand the access technology uses, challenges, and needs of DHH students, both in and out of the classroom.

The R&D center is charged with investigating, evaluating, and reporting on the most effective and efficient use of access technologies and train individuals in their use in order to accelerate the widespread implementation of best practices within deaf education at the postsecondary level [9].

During the 2017-18 academic year (fall 2017 and spring 2018), the R&D center's research faculty and students worked on several projects. The R&D center encourages students to develop and test prototypes of devices to benefit individuals with diverse abilities. Numerous prototypes and services directly resulted from the creative work of DHH students which was thoroughly vetted by subject matter experts, many of whom are DHH. Selected projects are listed below.

- **Real-Time Translation Service:** The R&D center has been conducting a pilot program with Microsoft Translator, an automatic speech recognition (ASR) technology, in several classes. The ASR team created custom language models with domain-specific terms for these classes in the pilot program and measured the quality of ASR transcripts.
- **Rower Accessibility:** In rowing competitions, rowers are required to follow commands from the coxswain, who determines the speed of the boat. DHH athletes may not have a way of understanding the coxswain during the competition and often resort to following other rowers. The R&D center's solution was to provide an offline ASR engine

connected to the visual display showing transcription and/or illustration for DHH athletes to obey coxswain's commands.

- **MUSEAI™:** DHH patrons in museums often face barriers by obtaining information about the artwork. The R&D center created a mobile app for patrons to view the signed/captioned video, transcript, and visual description as well as listen to audio description. The app offers three ways to transmit the media.
- **StyleUp!:** The R&D center provides support to a DHH student employee creating a web app where users copy and paste their writing to get feedback on three major writing-related areas.
- **Math Competition Application:** NTID hosts an annual Math Competition that targets middle school DHH students. In 2018, the software has been optimized along with new features including a bracket system, improved synchronization between question slides and the countdown timer, and the system to run on Raspberry Pi 3 was incorporated. Lastly, the mobile app for the scorers to use was developed.
- **Deaf-Centric Website Development:** The R&D center hired students to design and build web sites with a DHH audience in mind, with emphasis on video and a highly appealing visual design. Students built web sites for external and internal clients.
- **NTID 50th Reunion App:** NTID celebrated its 50th anniversary in June of 2018, and a few thousand DHH alumni turned out for the reunion. The R&D center developed a deaf-centric mobile application for the reunion.
- **Visual Communications and Arts Service:** The R&D center has a service where consulting on design ideas are given to clients on the artwork, brochure, logos, and user experience design for website and mobile app. Also, videography service including editing, captioning and voicing-overs was provided.
- **Real-Time Text Display:** The R&D center's goal is to improve accessibility in classrooms and theaters. Captions to be displayed above whiteboard in a classroom or on the stage utilizing Microsoft's Kinect or similar to track motion of one or more person(s) was developed.

U.S. Laws

In order to understand what employers need to know beforehand, there are U.S. laws in place for universities and employers to abide when dealing with DHH students or/and DHH employees.
Universities to provide auxiliary aids and services to DHH students:

Section 504 of the Rehabilitation Act of 1973 requires universities receiving federal financial assistance to provide qualified interpreters, captioning, assistive listening devices, and other auxiliary aids to DHH students. Title III of the Americans with Disabilities Act (ADA) requires all universities to abide [10].

DHH employee's rights in the workplace for the federal government:

Section 501 of the Rehabilitation Act of 1973 requires the federal government to practice affirmative action to hire and promote DHH employees. Also, it requires the federal government to provide equal access to training/promotion

opportunities and to provide reasonable accommodations for DHH employees
[10].

DHH employee's rights in the workplace for private company, state or local government agency:
Title I of the ADA prohibits employers, employment agencies, labor unions
and joint labor-management committees from discriminating against DHH
employees. It applies only to employers with 15 or more employees [11].

Participants

The participants are DHH undergraduate students from the NTID at RIT. All focus groups are
both video- and voice-recorded for documentation purposes. As a recruitment incentive, each
participant is compensated $50 for their time spent answering a background questionnaire
through Qualtrics, our survey provider. They then participated in a 90-minute focus group
interview. Ten volunteers who worked with the R&D center during the 2017-18 academic year
were recruited through email. For focus groups, the two participant groups (n=10) consist of: 1.)
six students who did not report to supervisors A or B during the AY 17-18 and 2.) four students
who did not report to supervisor C during the AY 17-18.

Hearing Status
Eight participants identified themselves as deaf and two of them declared themselves hard of
hearing. Seven participants have profound (>90 dB) hearing loss, two participants have severe
(61 dB to 90 dB) hearing loss, and one participant does not know the level of hearing loss.
Four participants do not use hearing assistive devices while five participants use digital hearing
aids and one participant uses both a digital hearing aid and a cochlear implant.

Demographic Information
Eight participants are male and two participants are female. Four participants responded to the
question on the survey about their age. The average age is 24.25 years old (SD=2.75, Range 21–
27). Eight participants identify themselves as Caucasian, one participant is Asian or Pacific
Islander, and one participant is from a Middle Eastern descent. Eight participants are U.S.
students, one participant is an international student and one participant is a community member
(not a student, but alumni). Three participants collect SSDI, two participants collect SSI, and five
participants do not collect either SSDI or SSI.

Education
Currently, three participants are fourth year in their majors, four participants are fifth year, one
participant is sixth year, and two participants selected "other." Nine participants will or received
a Bachelor of Science degree and one participant will receive a Bachelor of Fine Arts degree.
Student participants major are: three are in Software Engineering, three are in Computer Science,
three are in Human-Centered Computing, and one is in Graphic Design. One participant recently
graduated and the majority of the group will graduate in May 2019; with one exception of a
student who will graduate in December 2019.

Employment with CAT during the 2017-18 academic year
The data is collected and held anonymously, a list of all DHH student employees for fall
semester 2017 and spring semester 2018 for the data collection are shown below (Tables 1 and

2). Several DHH student employees worked for consecutive semesters and some of them worked for one out of two semesters. A few students worked on more than one project. Ten out of fifteen students participated in the survey and focus groups. The response rate is 67%.

Table 1. Employment with CAT during fall semester 2017 covering job status, position title, supervisor, hours/week, and projects(s).

Status	Position Title	Supervisor	Hours/Week	Project(s)
Co-op	Software Developer	A	35	StyleUp!
Co-op	Web Developer	A	35	Deaf-Centric Website Development
Co-op	Accessibility Engineer	B	35	Rower Accessibility
Co-op	Accessibility Engineer	B	35	MUSEAI™
Part-time	Software Developer	A	4	Real-Time Translation Service
Part-time	Usability Engineer	C	10.5	Visual Communications and Arts Service
Part-time	Web Developer	A	16	Deaf-Centric Website Development
Part-time	Software Engineer	C	20	Real-Time Text Display
Contract	Software Engineer	C	Various	Math Competition
Part-time	Video Producer	B	6	Visual Communications and Arts Service
Part-time	Software Developer	A	10	Real-Time Translation Service
Part-time	Visual Designer	B	8	Visual Communications and Arts Service
Part-time	Mobile App Developer	C	4	NTID 50th Reunion App

Table 2. Employment with CAT during spring semester 2018 covering job status, position title, supervisor, hours/week, and projects(s).

Status	Position Title	Supervisor	Hours/Week	Project(s)
Co-op	Web Developer	A	35	Deaf-Centric Website Development
Co-op	Accessibility Engineer	B	35	MUSEAI™

Co-op	Accessibility Engineer	B	35	Rower Accessibility
Part-time	Research Assistant	A	8.5	Real-Time Translation Service
Part-time	Usability Engineer	C	10	Math Competition/ MUSEAI™
Co-op	Web Developer	A	35	Deaf-Centric Website Development
Co-op	Software Engineer	C	35	Math Competition
Contract	Software Engineer	C	Various	Math Competition
Part-time	Visual Designer	B	10	Visual Communications and Arts Service
Part-time	Video Producer	B	9	Visual Communications and Arts Service
Part-time	Graphic Designer	B	10	Visual Communications and Arts Service
Independent Study	Mobile App Developer	C	6	NTID 50th Reunion App
Part-time	Research Assistant	A	10	Real-Time Translation Service

Two worked with CAT as their first employment and eight had worked prior to CAT. When the eight were employed, their CAT supervisor signed and two employees' CAT supervisor signed and spoke simultaneously (sim-com).

Language and Communication
Six participants are fluent in both American Sign Language (ASL) and English (i.e. bilingual), three participants are fluent in ASL, and one participant is fluent in Spoken English. Participants' language and communication results are shown below (Tables 3, 4, 5, 6, and 7). Note: sim-com is simultaneous communication where DHH uses both spoken and sign languages at the same time. CART stands for Communication Access Real-time Translation which is also known as real-time captioning. C-print is a speech-to-text (captioning) technology and service.

Table 3. Participants' preference in language and communication with deaf/hearing friends and signing/speaking supervisor

What language do you prefer to use for communication with your…	...deaf friends?	...hearing friends?	...signing supervisor?	...speaking supervisor?
American Sign Language (ASL)	8	0	8	1
Signed English	2	2	2	1
Spoken English	0	5	0	5
Other	0	3 (texting)	0	2 (sim-com)
N/A (I never worked with)	0	0	0	1

Table 4. Participants' preference method when receiving information from speaking employer
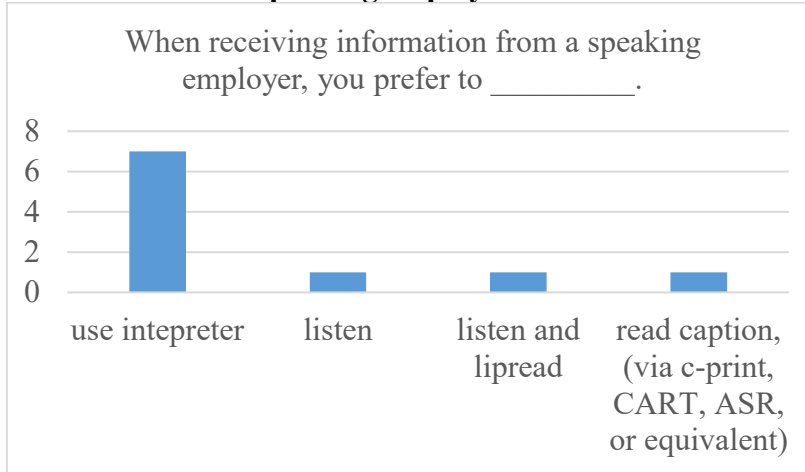
When receiving information from a speaking employer, you prefer to _____.

Category	Count
use interpreter	7
listen	1
listen and lipread	1
read caption, (via c-print, CART, ASR, or equivalent)	1

Table 5. Participants' lipread ability

Do you lipread?

	Count
Yes	7
No	3
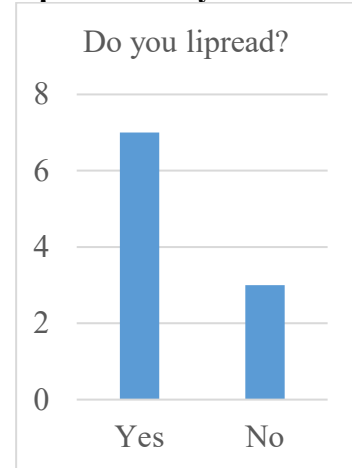
Table 6. Participants' rate of their spoken language skills

Rate your spoken language skills. Hearing people understand:

Category	Count
None of my words	2
Only a few of my words	2
About half of what I say	3
Almost everything I say	2
Everything I say	1
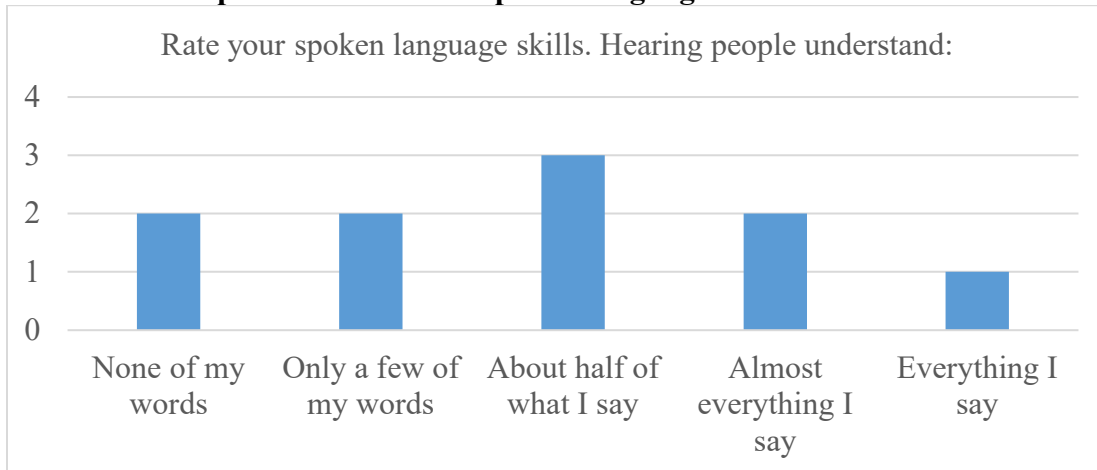
Table 7. Participants' rate of their sign language skills

Rate your sign language skills.

Category	Count
I do not know sign language	0
Basic	0
Fair	1
Good	3
Excellent	6

Data Collection and Analysis

The research design was to have the research team conduct a Qualtrics survey to collect participant demographics. Afterward, two semi-structured focus groups were conducted to provide a fuller picture of the experiences and needs of DHH student employees, as well as a more specific link between experience and accommodations. The areas the interviewer asked are:
- Their experiences prior working with CAT
- Their experiences while working with CAT
- Identify several characteristics of a good employer
- Any recommended accommodations to share with any employers when they interview, hire and supervise DHH employees
- Their perceptions and experience as a DHH employee

Direct communication between the DHH participants and moderators is essential in this study. Hence, moderators fluent in ASL led the focus group. The in-depth focus groups engaged the DHH participants and moderators in active dialogue.

During the focus group, the participants were recorded using a 360-degree, 4k quality camera manufactured by 360fly. This allowed capturing each participant, seated around an oval table, in one clip. The raw video footage was then transferred to a computer and processed by the editor from 360fly. Often a 360-degree video will be imported as a single frame video (and look distorted), so additional coding needs to be applied to make it spherical when viewing. After the video was processed into a spherical form using a 360-Metadata App, the video was uploaded to a private YouTube channel for viewing only by the researchers and interpreter.

The interpreter used a Samsung Odyssey Virtual Reality (VR) headset and a Jabra wireless microphone prior to connecting to the YouTube video. The reason for the VR headset is due to the fact it allows the viewer to seamlessly move and change the view within the 360-video without having to use any hand or mouse controls (in a typical 360 degree video, the viewer has to use the mouse or other keyboard tools to manually rotate viewing angles within the video). This allowed the interpreter to simply rotate in an office chair to view the entire room that the participants were recorded in.

Simultaneously, the interpreter used Microsoft PowerPoint's Presentation Translator add-in to allow for automated speech recognition (ASR) to be transcribed. Once the PowerPoint program was set up, the interpreter viewed the YouTube video through the VR system and translated ASL into spoken English; which allowed the ASR tool in PowerPoint to transcribe the recording. The new transcript was reviewed by researchers for accuracy by comparing the transcript with the original ASL recording.

For overall data analysis and interpretation, the analyses were conducted to identify common themes and perspectives reported by the focus group participants.

Qualitative Results – In the Workplace

The ADA and Rehabilitation Act require reasonable accommodations and it includes ensuring equal opportunity in the application and interview process, being able to perform and succeed essential functions of the job, and to be granted promotion. Focusing on employment hiring practices, unfortunately, prior to joining the university's unique R&D center, a few students experienced struggles or discriminations during their job interviews. To maintain the confidentiality of the participants, only student's background and skills are discussed in Tables 1 through Table 7 above.

Three DHH participants shared their frustration as in the stated underlined words below. One issue is have personally experienced discrimination, second is to disclose their disability because it is likely to result in job discrimination and the last issue is going through another interviewing cycle with the same agency.

> *"When I was in high school, I tried to apply at Target, but the interview was an awful experience. They discriminated against me. I had the same experience with the other three stores. They <u>discriminated</u>, too."* (P8)

> *"I think the first thing is not to make this so <u>awkward</u> because I find myself often not sure of when to disclose to people that I am hard of hearing. If I am at a phone interview, I know that I have to be in a quiet space. Also, I can't use a speakerphone because it sometimes was not clear. I have an experience where I am on a phone call with the call quality is really bad. I have to ask them to repeat. You know it makes the interview not go very well."* (P5)

> *"I did have an interview with the Department of Defense. They made a conditional job offer but withdrew, because of ethical concerns. They encouraged me to apply to different departments within the Department of Defense. <u>I turned it down</u>."* (P1)

One student reported a positive experience during the interview process and giving the credit to having accommodation policies and procedures in place.

> *"I flew down in person. They provided a sign language interpreter. I let them know ahead of time that I am deaf and they said it would not be an issue to provide a sign language interpreter. I think they <u>already were familiar with accommodations and accessibility</u>. I think because being a government agency, they <u>had policies and procedures</u> in place as opposed to a private corporation."* (P7)

After getting hired, the DHH student employees identified several characteristics of a good employer or supervisor hiring or working with DHH employees. Moreover, what is not just in offering them a good salary but how employers promote an environment where they feel valued. Three themes in workplace are identified in the focus groups: 1.) streamlining communications 2.) managing cultural differences, and 3.) be an advocate to co-workers.

Theme 1: Streamlining Communications in Workplace

In one of many studies, communication was identified as one of the primary barriers to DHH employees' career advancement [12]. It is of no surprise and well known the most common theme popped several times during the focus groups is communication.

> *"It is important that the employer has good communication skills especially knowing how to approach them in a good manner. At the same time, the employer knows what the employee needs. The employer is able to provide what the employee needs and they are able to work together. They will be successful. So* <u>*communication skills are a must*</u>*."* (P2)

Reasonable accommodations, with the goal of providing adjustment or modification to a job, may include videophones, captioned and/or amplified telephones, email systems, assistive listening systems, visual alerts, and policies and procedures for providing qualified interpreting service and real-time captioning, and so forth. Based on the focus group's responses, it is clear that not one size fits all. It is imperative to consult with DHH employees about the type of accommodations to streamlining communications among employees with disabilities. Quotes shown below shows that DHH students seem to know exactly what they need in order to succeed in the workforce.

> *"On making sure that they* <u>*provide interpreting related services*</u>*, first, ask the deaf person for whatever they might need before they get started but provide training for the team like an in service. I think setting the tone for other people or employees to follow… the model or the standards for everyone to follow."* (P6)

> *"As employers or as a boss, like if they're trying to talk using their voice all the time is that good advice, what should they do for meetings or what kind of accommodation should they provide. I will tell them to be aware of the background noise. Make sure it is in a quiet room. And if they want to have a conversation make sure, it's* <u>*in a small group*</u>*. Quiet atmosphere. And I know that's not typical to all deaf individuals, but that would fit me."* (P1)

Based on access technologies available today to facilitate the communication between employees, a few participants recommended using Slack. Slack is a one-stop site that brings all real-time communication together and keeps information in sync. The app offers messaging, sending notifications, and allowing the team to collaborate together on projects wherever they are located.

> *"I think it is really good to have a text-based conversation channel for the team like* <u>*Slack*</u>*, for example, where this benefits everyone not just the deaf employees."* (P1)

Ideally, the supervisors should keep abreast of emerging access technologies and trends. For example, during the year-end evaluation, the supervisors can conduct an employee pulse check by including a question on advanced technology that will streamline and improve the communications between employees in the workplace.

Theme 2: Managing Cultural Differences in Workplace

Sharing information and communication are paramount in the workplace but is not the only issue DHH student employees faced. One of few conclusions in a study recommends that employers should demonstrate culturally-appropriate perspectives in working with deaf employees [12]. Another repeating theme brought up in the focus group was dealing with differences in hearing and deaf cultures in the workplace. In two instances, the participants' suggestions are shown below. Both comments focus on the arrangements of movable furniture, fixtures, and equipment inside the building.

"I prefer an <u>open environment</u> like where I have some kind of table or open seating, instead of looking at a wall or working in a cube. You know the wall or cube kind of separates them from the team feeling. So the layout was frustrating. If I work as an intern, I do not expect to bring pictures such as the dog and something else to post on the wall. Working by the wall is an isolation experience. I prefer to work with no walls so I can see what is going on in the room. Easier to catch someone and discuss on work related matters instead of standing up and waving to get someone's attention. For example, to call for assistance or for communication purpose such as gathering ideas and brainstorming." (P9)

"I also want to add that, you know it is nice to <u>have a similar culture</u>. Of having to people who understand me is better than having to try to explain myself every time because if someone sitting behind me and trying to talk to me. I cannot understand them and I have to explain all that to people every single time. So it's great to be in a <u>place where everyone can understand me</u>." (P2)

In addition to room layout suggestions, employers and employees should be educated on cultural (and linguistic) minority and make an effort to come up with various possible inclusive solutions of how to manage the differences and reduce the gap between the two cultures.

Theme 3: Be an Advocate to Co-workers in the Workplace

Third and last common theme identified comes directly from hearing employees' attitudes and perceptions toward DHH employers. Hearing employees including supervisors need to strive at improving their sensitivity toward diversity in the workplace. A study reported that it is helpful for hearing workers to be supportive of their deaf co-workers. Being an advocate makes a difference to DHH employees in their daily experience in workplace [13]. Three entirely different testimonies are illustrated below.

"I could give one piece of advice. And this is from my experience. I have to do self-evaluations at my other job. And I have a hearing supervisor and some comments in the evaluation that I'm like, it didn't really bother me personally but I know what bother other deaf colleagues. I tried to share to the supervisor, "You have to be careful with how you word things." For example, there is one thing on the evaluation, it said, "I can speak clearly." And that is not really appropriate wording. You could say I can communicate effectively. That might be a better assessment tool. So I tried to provide that advice because I want the hearing supervisor to be knowledgeable

about how to word certain things because I do not want them to come across as offensive especially to those who could perceive it that way." (P5)

"I think this supervisor could maybe take some kind of training or workshop for people with disabilities even include training about working with deaf and hard of hearing employees. It is important to be aware of accommodations and be approachable such as asking if there is access that is needed. In general, many employers tend to say, "I am sorry, how can I help you?" Do not say that. Just ask straightforward, "What do you need?" They can be aware of it and even offer it ahead of time. You know I think that the interested employer needs to know that they need to be accommodating to the individual's needs. If they need an interpreter or if the deaf person has a very important meeting, it is better to provide an interpreter than writing notes back for the paper." (P9)

"When I was at another company. I had a sign language interpreter and I think this one day, I did not have my regular interpreter. So I tried to explain some background information to this new interpreter and I think the interpreter misunderstood what I was saying or what I was trying to say. The interpreter had difficulty voicing for me and I saw that my boss seemed to think that I did not know what I was talking about. And my boss just kind of disregarded it or didn't even bother to clarify. I was only there a few weeks at the time, but when I asked a question through that interpreter, I didn't speak for myself at that point, I use the interpreter. But I think that it's just that situation, it made me feel really uncomfortable, I wasn't able to clarify what was said or to say that it was not me that didn't know what I'm talking about but really it was the interpreter. But I just kind of accepted that. You know, at that time I was just disappointed that the boss did not work with me. The boss just kind of assumed. It seemed easy for the employer to brush it off." (P7)

To get both DHH and hearing communities to work together in a workplace, it is a matter of time, patience and being actively engaged in education on diverse topics to make this happen. Ultimately, DHH employee's success in a workplace would increase exponentially working with an advocate. In other words, it will allow everyone to have the tools to be on equal footing.

Discussion - Experience with deaf faculty-led R&D center

DHH student employees saw many benefits working with a deaf faculty-led student-centric organization namely the NTID Center on Access Technology (CAT) and based on their experiences with this R&D center, they would fare better if employers provided reasonable accommodations. The common benefits the DHH student employees mentioned repeatedly are 1.) direct communication, 2.) cultural awareness, 3.) deaf and hard of hearing advocate, and 4.) professional role model.

- **Direct communication –**
  "CAT is a very rare experience because it actually provides the technical challenges and skills on real-world projects. It also the <u>direct communication</u> access to actually

give you started it you started on the right footprint. So that you can go to other companies and have more confidence in your skills." (P4)

- Cultural Awareness:
  "I do not have to explain to co-employees why I wear a hearing aid. I cannot read lips if you are sitting behind the table. Little things like that. Deaf employees already know. <u>All set and no need to explain it to them</u>." (P5)

- Deaf and Hard of Hearing Advocate:
  "When people come out to visit or when we network with other clients, the CAT team always <u>promote student workers</u> in the let's us shine instead of taking all the credit for themselves. So it actually really helps us develop our network. Because we're getting credit for the work that we do." (P7)

- Professional Role Models:
  "And for me, I grew up in a place where I didn't know or meet people who are <u>deaf professionals</u>. I never met anyone else who is deaf and older than me. So coming here, I had an opportunity to meet deaf professionals who are well educated and hear their stories and share common experiences with them." (P5)

DHH student's experience being employed in a unique R&D center led by deaf faculty provides students the inclusive opportunity to experience the same equal benefits and privileges of being in a "hearing" employment. Despite DHH student employees' backgrounds and upbringings, education they received, prior and current work experience they gained, laws in place to protect them, and last but not least, advanced access technologies available to them, there is more work to be done.

Limitations

This study has a few limitations. Based on the answers from the survey CAT student employees took, a few students did not complete some areas asking for more information. For instance, not everyone typed in their age. It seems, the mobile survey, where it asks for the person to type in information, is not intuitive. In other words, user experience design for the survey needs more work.

For the focus groups, the original plan for the two focus groups (n=10) to consist of: 1.) five students who did not report to supervisors A or B during the AY 17-18 and 2.) five students who did not report to supervisor C during the AY 17-18. N = 5 per focus group x 2 groups equal 10. However, one participant, who was out sick for the first focus group, agreed to attend the second focus group. This situation produces a minimal conflict of interest with the interviewer because that participator who was sick reported to that supervisor. Any comments recorded on the transcript that reveal the conflict of interest is omitted from the research study.

Recommendations for Future Research

Based on the research findings noted, an employment guideline for employers hiring DHH employees will be developed and disseminated. It will include, but not limited to, effective ways to communicate between DHH employees and their hearing co-workers, different ways to overcome cultural differences, and become a more advocate of co-workers.

Acknowledgments

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