SIGN LANGUAGE INTERPRETERS – A REVIEW OF BEST PRACTICES IN THE STEM FIELDS

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Introduction

Despite turn-key solutions of interpreting provided to deaf students in post-secondary institutions due to the case of Howard (1993), interpreting in employment is still an emerging field. Rather than reinventing solutions or utilizing existing processes originally meant for deaf students, processes for deaf academics require a re-examination of interpreting. In a sense, we are looking for accommodation from a disability or a language point of view (Burke 2017). Taking the lens of phonocentrism it is argued that the interpreter as the third person interrupts the usual direct communication path between two individuals which deviates from the typical privileged use of the body to speak [or sign] a language (Young et al, 2019a; Young et al, 2019b). That is the voice of the Deaf person comes from the interpreter instead so the connection between the source of language, the language itself and the body is not there (Young et al, 2019b).

Additionally, there are potentially other factors in the interpretation interaction, including social consequences, the nature or context of the interpretation and the domain the interaction is in (Burke 2017). To add context within Canada, Elbridge (1997) mentions that the justices of the Supreme Court of Canada recognize that the identity of Deafness is not just in the biological sense, rather this is more than just the concept of disability, it is social (Snoddon & Wilkinson, 2022). This means understanding the social circumstances that cause the barriers in place from a societal perspective (Snoddon & Wilkinson, 2022). A direct quotation is provided here (Paul & Snoddon, 2017):

“This historical disadvantage [of deaf people] has to a great extent been shaped and perpetuated by the notion that disability is an abnormality or flaw. As a result, disabled persons have not generally been afforded the “equal concern, respect and consideration” that section 15(1) of the Charter demands. Instead, they have been subjected to paternalistic attitudes of pity and charity, and their entrance into the social mainstream has been conditional upon their emulation of able-bodied norms. (Eldridge, par. 56)”

Recently, such barriers have also been documented in a large European research project (DESIGNS) funded through the Erasmus+ program. This research examined the employment circumstances of deaf signers (Napier et al 2020). One key theme found in the employment pathways (1:1 meetings, group meetings, progression, conflict and social settings) was the impact of the interpreter. This theme was identified with gaps in knowledge, organizational culture, feedback and the systems in place.

Guidelines are needed to meet the needs of the interpreters to ensure stakeholders get the best outcome in any interpreted event (Napier et al 2020). Expectations of the interpretation process will depend on the context and background of the interpreter (generalist or specialist). Gaps in the interpreter's experience and knowledge need to be acknowledged by all participants. Knowing the culture(s) that exist within the organization is important for the interpretation process. Lastly, the system gap identified for interpreters revolves around the provision of interpreters to provide access and participation by deaf employees. This is analogous to what is available for hearing employees, including services provided through health insurance, external training opportunities funded by the employer, and to engage in part-time education (Napier et al 2020).

An examination of the interpreting process and identified gaps are needed as it is recognized that interpreting as an institution in Canada “…may manifest existing societal hierarchies and ideologies”

(Snoddon and Wilkinson, 2022). To resolve such issues within the institution of interpreting identified solutions or processes to such barriers are meant to be fluid and adjusted from time to time rather than being set in stone (Chua et al 2017). From the literature, best practices for interpreters have been identified when working with Deaf researchers and staff, with the scope narrowed down to the STEM fields and aimed at filling in the gaps specified in the DESIGNS project by Napier et al (2020).

A macroscopic view of sign language interpretation

Before examining those best practices identified from the literature, understanding how sign language interpretation came into being is crucial to grasping its advantages and weaknesses (De Meulder & Haualand, 2021). Increasingly, interpreter services are being examined as a "quick fix for inclusion" as stated in De Meulder & Haualand (2021). Moreover, in the recent decade, the interpreter has been recognized as a participant in the communication interaction rather than a neutral facilitator of information (Haualand et al 2022). Perspectives at micro and meso levels are more common, while those at the macro level are less so (Haualand et al 2022). So there is increasing awareness that the interpreting process is a system interlocked in complex ways with other social institutions existing in one's society (Haualand et al 2022; De Meulder & Haualand 2021). The concern is that sign language interpretation gives the wrong impression that deaf individuals can participate on equal terms. But in actuality, it's more complicated than that (Haualand et al 2022).

In particular, the interpretation process involves at least two distinct processes occurring – for example, ASL-English interpreting includes both bilingual and bimodal processes (Burke 2017). The bimodal aspect of interpreting means the communication is asymmetrical which burdens more the deaf participant as opposed to the hearing participant (Burke 2017). Other options are potentially available but not well considered from an inclusion lens, particularly the possibility of introducing language-concordant services. This comes from a view of cultural-linguistic aspects where this is a language discourse between two cultural groups rather than just taking a medical disability point of view (Young et al, 2019b).

In the STEM fields, this means having scientists who are hearing and know how to communicate in sign language, typically American Sign Language (ASL) as used in Canada and the United States (De Meulder & Haualand 2021; refer to Napier et al 2020 for a European perspective). In this sense, once hearing scientists learn ASL through online ASL classes taught by Deaf instructors or faculty, and become passable in scientific discourse when working with Deaf scientists – this may be a feasible solution. This would be rather than solely relying on sign language interpretation. This approach is not well explored in literature, although appears to be recently changing (De Meulder & Haualand 2021).

The concern is that Deaf scientists may be known to hearing scientists as "interpreted self" or lived experiences as communicated through an interpreter (Young et al, 2019b). This means the Deaf scientist can potentially have a loss of agency in controlling how to be represented and knowing that interpreters have the privileged position of giving meaning to the Deaf scientist (through identity, voice tones, choice of lexical context and so on) (Young et al, 2019b; also mentioned in Burke 2017). So it is the lack of language-concordant scientists that has been identified as one of the underlying issues in the workplace where Deaf scientists are (De Meulder & Hauland 2021). This comes from knowing that interpreters are an imperfect solution and this is similar to other contexts of spoken language settings (i.e. Latinos & Asian Americans in the United States), where language-concordant services are associated with better health outcomes even when interpreters are made available.

In addition to the context described above, as outlined by McLaughlin (2011), involved factors were identified for the current interpreter shortage: availability of benefits, mentoring and work in video relay

and remote video interpreting. As well, those 4 factors were expanded to add context to the interpreter shortage with 11 other factors described. It has been suggested that this be resolved by booking interpreters months in advance (Burke 2017). From the perspective of the deaf individual, this context leads to a mismatch of needs (Burke 2017). Given the interpreter shortage issue, this is typically commonly mentioned as an issue in the interpretation process.

The communication barriers as identified are complex: interpreter shortages mean many bookings go unfilled, unequal language status (spoken vs signed, knowledge of interpreting services), potential loss of agency and lack of awareness of the interpretation process with its constraints and capabilities (Burke 2017; McLaughlin 2011; De Meulder & Hauland 2021; Young et al 2019; Hall et al 2019). Those complex issues in interpreting and the broader context of the choices made when finding solutions to the communication barriers need to be better understood by all parties involved. So the identified choices should be carefully considered and discussed with Deaf professionals, staff and students within a safe space.

The basics of interpreting

The importance of comprehending what the impact of the interpreter can be on the communication interaction between a Deaf individual and a hearing participant (Haualand & Nilsson, 2019). This interaction should give a heads-up to the participants for a different way of communicating, possibly complicated by other factors, normally not present in direct communication between participants. Language describing this interaction needs to be carefully defined, that is to "work with" or "cooperate with" the interpreter so that the responsibility of the communication is given to the hearing participants, not the interpreter of the Deaf individual (Haualand & Nilsson, 2019). Moreover, the interpreter could be called a "ratified participant", with the presence justified by the participants' need for interpreted services. This also allows the hearing participants to orient themselves so the communication is in the deaf person's cultural-linguistic identity. Then everyone in the communication interaction knows this is an interaction of different language users (Haualand & Nilsson, 2019). The 'delay' in the information that reaches the participant in the communication interaction, is also known as 'lag time'. Existing models in the literature highlight the need for lag time when processing information, suggesting that this communication interaction is understood as processing time. This allows the participants to be aware of the lag time. This lag time is inherent in a discourse that is interpreted by a ratified participant who needs to process such information, so the responsibility in this process is made more clear (Hauland & Nilsson, 2019).

For each academic assignment, three broad categories are required for interpretation including the capability to do the assignment, prepare for the assignment information on hand and ensure that the environment (both physical and social) is prepared for the interpretation process (Knox 2006). Challenges that are seen in the three broad categories are often from misunderstandings (Knox 2006). Those misunderstandings can come from the interpretation of diagrams and descriptions that are done verbally, as well as 'visual shifting' as examples (Knox 2006).

Interpreting technical language comes with the challenge of taking a sign language that the interpreter is typically using as a second language and taking those technical concepts as academic jargon by fingerspelling such jargon or having the deaf client agree to a sign on the spot (Knox 2006), known as "home signs". This agreed-on sign is often valid for only the interpreting assignment, not outside the assignment as it can be a home sign and not recognized elsewhere (Knox 2006). The lack of existing sign language for technical concepts is due to the history of excluding sign languages from the academy and

society (Knox 2006). This theme is more recently now proposed as “minoritized” languages due to this exclusion coming from stigmatization and power differentials (Scott et al 2023).

As Grooms (2015) has explained, the competencies of ASL interpreters in the STEM fields include:

- Be able to adapt to the signing approaches (including transliteration).
- Content knowledge of the STEM discipline, to some degree but not at the level of content knowledge experts in the same STEM discipline.
- To identify interpreters via "specialty" credentials to ensure appropriate fit in the STEM field.
- Understand the jargon of the discipline.
- Deciphering foreign accents, be managed by being present with the same participants in the workplace setting over time.
- Be willing to work in different environments (fieldwork, laboratory) as the context changes.
- Preparation for assignments and presentations by the deaf professional or professionals working in the same discipline.
- To advocate for interpreter needs in partnership with the deaf professional.

Historically, sign language interpreting was set up to communicate information from the hearing majority society to a deaf minority culture group, so the flow of information was from spoken language to signed language (Haualand & Nilsson, 2019; Hall et al 2016). This is less so those days, with communication occurring both ways, so this will require an intense cognitive process that takes time (Haualand & Nilsson, 2019). Holcomb (2018) has acknowledged the field of interpreting still calls for more research to manage this cognitive process between the interpreter and the Deaf professional. One direction being explored is to ensure this process is Deaf-centric, currently called the DEAM approach (a translation of deaf, dream, and team). One suggested modification to the interpretation process so that the Deaf professional can verify the interpretation (the “trust” aspect) through a 3rd interpreter added to the current practice of two interpreters in a team. This third interpreter will take what is interpreted by the team and feed the ASL translation back to the Deaf professional. In doing so, the Deaf professional can trust the interpretation and ensure accountability to the interpretation process (Holcomb 2018).

In addition to the DEAM approach, as suggested by Holcomb, the designated interpreter paradigm was recently updated by Hauser et al (2022) expanding on work by Hauser and Hauser in 2008. The designated interpreter is a long-term employed individual who distinguishes characteristics based on “intersubjectivity” derived from cognitive linguistics within interpreting/translation theories (Hauser et al 2022). This means the interpreter needs to have the same context understanding as the participants involved in the bilingual interaction (ASL to English, et cetera), so fewer assumptions are made about the knowledge being exchanged. Making this workable, requires the interpreter to be present in the workplace long term, as this time allows the partnership between the deaf professional and designated interpreter to become effective (Hauser et al 2022). The more time in the workplace, the more awareness of shared knowledge, attitudes, and behaviors known by the designated interpreter, and the more capacity to focus on intersubjectivity aspects of interpreting. At that time, it is only then that the Deaf professional can focus on what to say rather than how the self is being interpreted (Hauser et al 2022). It is noted that if interactions between non-signers and a deaf professional (or professionals) are encountered daily, then it becomes a case where a pool of interpreters (both designated and preferred interpreters) is needed (Hauser et al 2022). This is particularly needed when events require more than one interpreter to manage the workload, making this pool of preferred interpreters essential. Having such a pool of interpreters means that the intersubjectivity challenges are better addressed with interpreters familiar with the Deaf professional (Hauser et al 2022).

How to prepare the environment for the interpreting process

To ensure the interpreting process works well in the setting, the factors of consideration will include (Knox 2006): academic staff relationships, dynamics in the classroom or workplace, sensitivity to cultural differences, visual aids, and presentations by deaf students and academics. This is further supported in Smith & Ogden (2018) with content knowledge and socio-cultural aspects emphasized for Deaf faculty and staff working with interpreters. Napier et al (2020) have stated that guidelines are needed to describe what is required in terms of accessible training for meetings, conferences, or other events when interpreters are involved.

The response from faculty or lecturers can vary from a keen desire to create an ideal interpretation experience to outright resistance to having an interpreter in the classroom or the workplace (Knox 2006). This negative view is rare but does happen so the interpreter needs to be prepared for such cases with a positive approach, with awareness to avoid power conflicts in relationships (Knox 2006).

In contrast, the roles of Deaf faculty and staff are understandably different than those of Deaf students in higher education (Smith & Ogden, 2018), so the interpreting process differs. One example is the necessary emphasis or attention on slight changes in what is being said or nonverbal messages (the "semantics" of conversations) (Smith & Ogden, 2018). One unwritten rule in the academy is the ability to interact with other faculty members, both in the department and outside. This is and can be a form of networking, so outside the typical classroom environment this aspect of interpreting can be considered most critical of the Deaf academic work, and interpreting this type of interaction can have an impact, both positive and negative (Smith & Ogden, 2018). This networking often leads to gaining resources and funding for research projects and so on – showing its importance.

In addition to the presence of interpreters, the physical environment can matter (classroom or laboratory) (Smith & Ogden 2018; Napier et al 2020). The arrangement of where the interpreter is located is typically worked out with the Deaf faculty or student beforehand so allow this to naturally occur, as resistance from hearing faculty is often seen to this (Smith & Ogden, 2018). If the input is possible for a building before construction, ensure Deaf views are incorporated. For instance, arranging all classrooms in a U-shaped configuration ensures everyone can see each other. Acquire laboratory equipment that is Deaf-friendly, such as a fume hood designed to be accessed on two sides. This fume hood style allows an interpreter to be placed on the other side and the deaf student or faculty sets up the experiment (Smith & Ogden, 2018).

As attending conferences is an expected activity for academics to do, this can be a challenging activity for Deaf academics to undertake (Smith & Ogden, 2018). This comes from the still unclear understanding of who is responsible for paying for the interpreters' time. Depending on the conference size (from thousands of attendees to less than a hundred), the interpreter fees can impact the budget of a conference if not planned. Of course, the best solution would be to have the conference take on the interpreter cost, however, this does not always occur. A secondary solution would be that the home institute of the academic is to pay the interpreter fees and the conference takes on the travel expenses of the attending academic. This secondary solution is problematic, as this can create imbalances in access for part-time faculty and graduate students as opposed to full-time faculty who have the interpreters booked. So it is wise to reach out to the conference organizers in advance, preferably through a colleague of the Deaf academic who is well-versed in those matters, to arrive at a solution.

Dynamics in the classroom or workplaces

Provisions are needed in the physical aspect of interpreting, to take breaks as appropriate depending on the nature of the interaction or what the agenda outlines for an event (Knox 2006; Napier et al 2020). Typically this is 15-20 minutes per turn in academic interpreting (Knox 2006; Holcomb 2018). Additionally, when working in a team, further considerations are taken in by both interpreters – for example to what strengths each interpreter in the team offers to the interpretation (Knox 2006). In group work, fatigue can occur from a lack of facilitation or understanding from the instructor (Knox 2006). This can happen when the group work requires mobility or continuous group work where breaks by a single interpreter cannot be done (Knox 2006).

If the deaf academic is new to teaching, it is advisable to identify the common resources available at one's institution or university – on teaching, learning and curriculum teaching and ask the interpreters to join and utilize those available resources (Smith & Ogden, 2018). This will allow the deaf academic and the interpreter to work out the best arrangements for teaching in the classroom.

Newly hired deaf academics usually undergo an interview process and this has recently been given attention in the literature (Alley & Otto 2024). Utilizing a filmed interview, a reported range of 37-52 hesitancy interjections by interpreters recruited for this study. This demonstrates the need to raise awareness amongst employers that the interpretation process can involve verbal nuances, with disfluencies and qualifiers as examples. Those verbal nuances must be treated separately from the ASL language the deaf academic or professional expresses in a job interview. Not doing so can have a direct impact on the determined suitability of the job interviewee for a position (Alley & Otto 2024).

More attention should be given to presentations of deaf academics at conferences where the audience is the peers of the deaf academics, usually not deaf themselves (Smith & Ogden, 2018). This is where interpreters need to be aware of the limited room of mistakes allowable and to ensure that preparatory work is done well before the conference itself so that the interpretation of the presentation is with a good understanding of what the deaf academic will do (signing style, the context of the presentation, possible questions or comments to expect from the audience at the conference). As written by Hauser et al (2022), one of the goals of the Deaf professional attending conferences is networking with other non-signing professionals in the side events typically held during a conference. For such networking, the interpreter must know the agenda of the organization hosting such an event, that of the Deaf professional and the individuals present (Hauser et al 2022). This supports the intersubjectivity in the information exchanged between deaf professionals and non-signers (Hauser et al 2022). Not knowing the agenda context means that the translated self of the Deaf professional can be misunderstood and worse go backward in the networking interactions in the side events.

Etiquette basics should be shared with students from the Deaf faculty or student point of view when working with interpreters (Smith & Ogden, 2018). Those include direct questions or comments to the Deaf faculty or students as normally done if the interpreter is not there, speak clearly and loudly for the interpreter, especially in noisy environments such as laboratories. Another basic is to describe the interpreting process, including lag time in processing the conversation as well as giving heads-up comments in the workplace will be interpreted by the interpreter and if unclear, ask to repeat or clarify the comments (Smith & Ogden, 2018).

Unwritten rules exist in the academy so typically experienced Deaf faculty or workers will provide this type of information to interpreters new to this kind of environment and will do so at appropriate times, do pay attention when this advice is given and keep this confidential (Smith & Ogden 2018; Napier et al 2020). Those can include the location of meetings, names of others present, key figures within the workplace environment and staying informed about what others are discussing on an informal basis

(Smith & Ogden, 2018). Do share this kind of information with Deaf faculty at appropriate times and quietly do so.

This kind of incidental information is crucial, as this information is typically overheard in the hallways, restrooms, or public places. Specific examples include knowing who is considering retiring, a new rule possibly being implemented, or even personal aspects (Smith & Ogden, 2018). A notable example given by Smith & Ogden (2018) describes a meeting where a department committee voted on a fellowship being awarded to a doctoral student and went against awarding this fellowship. The interpreter in the meeting successfully identified the nonverbal language and tone of the fellowship director implying that the fellowship was still open for the student. The deaf faculty in this meeting took this cue from the interpreter and initiated an appeal to the fellowship director. This was eventually successful, with the fellowship awarded to the doctoral student. There is a caveat in the Deaf culture where it is expected that information sharing is done, so interpreters should conduct themselves in this aspect and relay all information of the department workings and the institute system to Deaf faculty so that their work has an impact on the institution (Smith & Ogden, 2018).

Similarly, getting to know a Deaf colleague socially in the workplace is essential as within workplaces, informal incidental discourse about the workplace from the people within such workplace gives everyone clues as to what are the effective ways to achieve a goal (knowing your social and cultural capital) (Young et al 2019b; Hall et al 2019). This awareness of how much knowledge one can get from incidental information in the workplace is not consciously known by hearing individuals, which is a challenge as many professional relationships are based on verbal communication (Hall et al 2019). Essentially “Deaf people are the last to know” and this remains a challenge yet to resolve.

Taking the view of hearing colleagues with lower hierarchy status in the workplace of Deaf workers, it was commented that it takes longer to have rapport between the hearing individual and the Deaf worker as without language-concordant communication, this rapport is done in alternative ways, by email or dependent on the third person, the interpreter (Young et al 2019b). The same was found for another hearing colleague who hardly knew both hearing and deaf colleagues lower in job status, appropriate to status in the workplace as opposite to communicating (Young et al 2019b) indicating other factors at play. At the same time, it was commented that for a work team to function well, it is important to know your colleagues socially (Young et al 2019b). Even with an interpreter present, this felt not informal or spontaneous as commented about informal chats between hearing individuals, that is chats in elevators as a specific example.

Utilizing an interpreter is a trade-off between what is said (content knowledge) and who the person is (person knowledge) (Young et al 2019b). In other words, you give up forging a relationship with the Deaf person to get what was said by the same Deaf person (in terms of context). In general, this is not what hearing individuals experience in the workplace (Young et al 2019b). Rather hearing individuals have language as typically acquired in one’s family and community, so language isn’t a limited resource (Burke 2017). Hearing colleagues have commented that it's not just paying attention to the interpreter, you also have to pay attention to your Deaf colleague, in the sense of capturing the emotions, behavior, and state of being of the Deaf colleague that is not always taken in by the interpreter (Young et al 2019b). This information can be overlooked for multiple reasons, such as the interpreting time lag or not being fully captured (Young et al 2019b). As well, this interaction can also be implemented by one’s bias or views on associating Deaf as a detrimental disability or thinking the interpreter is “for” the Deaf individual rather than seeing the interaction as an intercultural and bilingual approach, outside of the medical point of view of disability. This interaction is now termed ‘translated deaf self’ with the following definition: ‘the socio-cultural impact for deaf sign language users of multiple, regular, lifelong experiences of being

encountered by others and inter-subjectively known in a translated form i.e. through sign language interpreters' (Young et al 2019a).

Additionally, the "interpreted self" of the Deaf scientist can also be true for the hearing scientist, that is hearing scientists are masked or less knowable to the Deaf scientist or the Deaf scientist has to feel discomfort with the communication adaptation for the hearing scientist, which appears not to be considered from the view of the hearing individuals in the workplace (Young et al 2019b). Also coming from this research done by Young et al (2019b) hearing colleagues have "…the desire to know the person who is deaf." and this "knowing" can be detrimental or conducive to this by the interpreter, depending on the context and complexity of the information discussed.

Content knowledge

As the deaf academic holds the content in the scientific field of work, there is a need to work out a process with interpreters so that the interpretation accurately states what the deaf academic has signed. To support this interaction, it has been suggested that the involved interpreters pay attention and get familiar with the cues provided by the deaf academic (Smith & Ogden, 2018). Cues include the use of fingerspelling on purpose and the use of backchannel conversations with the deaf academic including the use of a facial cue or ask to repeat.

At the same time, it is recommended that interpreters ask questions and request reading materials from the Deaf academic the interpreter(s) are working with (Smith & Ogden, 2018). Depending on the work context, it can be the textbook of the course, slides for a presentation and so on. Ultimately, the interpreter needs to have a willingness and ability to learn advanced scientific content and follow the lead of the deaf academic (Hall et al 2019). In time, the interpreters if booked consistently, can then become designated or preferred interpreters for the Deaf academic (Smith & Ogden, 2018).

As described by Vesel et al (2024) utilizing signing STEM dictionaries online helps improve the scientific terminology knowledge of interpreters who participated in the study. Additionally, the interpretation of lecture material was enhanced in terms of fluency and accuracy. However, signing STEM dictionaries was not associated with improvements in context knowledge. As well as what Vesel et al (2024) reported, from the perspective of the workplace, Napier et al (2020) noted that multiple participants stated that bilingual glossaries of terminology should be developed for use.

Interpreters should be made aware of the advantages offered by signing STEM dictionaries that exist online. Additionally, the level of fluency in such a sign language was found to be important if accessing such signing STEM dictionaries online. In one study, interpreter students in upper levels of an interpreting training program were able to make use of while interpreters with less fluency were less so (Vesel et al 2020). Note that this single study was not extended to other interpreting programs, indicating more research is needed (Vesel et al 2020).

Preparation of materials – visual aids, meetings and presentations

Preparatory materials allow an understanding of the required prior knowledge of the subject matter (Knox 2006). This can vary from reviewing lecture notes and PowerPoint presentations to asking for referrals to materials by instructors or lecturers (Knox 2006; Napier et al 2020). Less commonly done, however, is recommended in that feedback is provided to the interpreter after the interpreting assignment (Napier et al 2020). This approach to offering preparation material and feedback can be arranged for each booking in advance. This is important as knowing the setting depends on the majority group the interpreter will work with. For example, if the majority group are deaf speakers, then the direction of interpretation is sign

language to spoken language (Knox 2006). In addition to this if the topic on hand is technical, then typically the jargon has to be learned beforehand not during the interpretation (Knox 2006).

Another layer is the approach of presentations where the norm is to explain the reasoning and then state the main point. The reverse is true for Deaf presenters, where it is to state the main point first and then explain the justification behind the main point (Knox 2006). Approaches to conversations can also include reading directly from notes (verbatim in English), going into the subject-verb-object order that exists in English but not in ASL, be causal in discussions with the audience, where participation is looked for (Smith & Ogden, 2018). The selection of the approach in presentations or conversations will be dependent on the experience and preferences of the Deaf academic.

Taking pauses in the presentation given by a deaf academic is considered a best practice as this allows the interpretation process to proceed smoothly, to catch up, and to provide breaks for the interpreters to process the given information (Smith & Ogden, 2018). Also, with consideration of the space the presentation is given in then strategies include signing on the side of a podium, using a larger space for signing, and selecting when to pause appropriately (i.e. between slides so that participants can glance at the slides before the interpretation process starts again) (Smith & Ogden, 2018).

Preparation for group work or meetings with multiple participants often requires that turns be taken in sequence with no overlapping (Knox 2006). This is due to the inability to interpret more than one source of language (Knox 2006). This is an environmental impact where individuals have to be conscious of what bounds the interpreting capacity exists (Knox 2006).

The concept of visual shifting comes from a lecturer or instructor presenting information in a classroom where the use of writing or drawing, pointing, or expressing occur all at the same time (Knox 2006). The challenge for the deaf student is that eyes are on the interpreter, not the lecturer or instructor so giving more than two sources of information is not physically possible for the student (Knox 2006). This is in the sense the eyes are already on the interpreter so any pointing to visuals will be missed by the student who is paying attention to the interpreter (Knox 2006).

Another example of visual aids is employing hands raised to interrupt discourse while hearing people do so with verbal cues (Knox 2006). Interpreting this kind of discourse and interruptions is challenging, and the cultural differences are typically not accounted for by the interpreter or the interpreter team. This is due to being at least a half sentence behind the ongoing discourse (Knox 2006). The necessitated turn-taking and timing with the delay in interpreting the discourse can lead to unclear perceptions or confusion in discussions and misunderstandings between participants (Knox 2006).

The incorporation of concepts or words unfamiliar to the students in the classroom is an issue teachers and interpreters should be aware of, especially how to evaluate a deaf student's knowledge of those unfamiliar words (Stinson et al 2009). This finding came from a study that compared lecture material based on CART or interpretation. This comparison was conducted by evaluating the results of two types of tests: multiple-choice and completing sentences. More difficulty was found in dealing with unfamiliar words when using interpretation relative to CART when doing the sentence-completion test (Stinson et al 2009). This is in the sense that interpretation of unfamiliar words exists for a very short period (as in seconds) as compared to the access of CART where the unfamiliar words exist on a screen. So if it is known that a course will introduce unfamiliar words comprising many letters, it is wise to prepare for this ahead of time (Stinson et al 2009). However, it is essential to note that employing CART or interpretation appeared to be equivalent in retaining information with no difference, only that introducing unfamiliar words may be problematic to teach in the classroom (Stinson et al 2009). This no-difference outcome was also connected to the student's level of reading comprehension, indicating the ability to absorb

information is strongly associated with the ability to read (Stinson et al 2009). Similarly, in Marschark et al (2008), the teaching of STEM topics, whether by direct instruction or interpreted instruction, was determined to be effectively equal for deaf college students, with no significant difference observed in the instructors' multiple-choice tests (pre/post-tests). This shows that learning STEM materials and their assessment depends on the context as mentioned in Stinson et al (2009).

Sensitivity of cultural differences

It has been noted that the host post-secondary institution needs to take responsibility for ensuring cultural differences are effectively handled and dealt with respectively (Knox 2006). Cultural discourses of deaf individuals are known to differ and vary from hearing people, and this goes into how context is presented (Knox 2006). A classic example is the language differences (American Sign Language vs English) where the main point is stated then comments and opinion reasonings are made of the main point (Knox 2006). The opposite is done by English-speaking hearing individuals, where reasonings are made before a main point is stated (Knox 2006). Along with the differences in the languages in use (ASL, English), taking account of visual cues as normally done by deaf people need to be taken into by the lecturer, facilitator, chair of the classroom, laboratory, or meeting respectively (Knox 2006).

As described in Burke (2017), the presence of the interpreter in the communication interaction means the interpreter is essentially an "uninvited guest" in a Deaf person's life, particularly in the workplace. This presence alters the Deaf person's interactions with hearing colleagues (also mentioned in Young et al, 2019b). This is important to note as the information a Deaf scientist needs to make informed decisions is dependent on the communication access provided by the interpreter and is usually decided in one's accommodation request.

As opposed to professionals including scientists, physicians, teachers and so on who may be working with a Deaf client within their areas of expertise, interpreters can appear anywhere in any domain. This can be unsettling for the deaf individual, as the expectation of privacy for working with such professionals, is unclear with the interpreter profession (Burke 2017). This is a difference that hearing individuals don't have to consider.

Another factor to be aware of is that the group of signing deaf is known to be highly variable in the sense of knowing the sign language of one's community, the dominant spoken (written) language, ability to hear, educational background and differences in the deafness (also associated with low vision and blindness) (Burke 2017). Those terms are meant to show the variation of signing deaf to show the challenges in interpreting for the variable deaf individual in the workplace (Burke 2017).

Empowering deaf students or faculty to manage the interpreting process

The involvement of the Deaf individual in the interpreter selection process is known to be inconsistent (Burke 2017). It is felt that this variation of involvement is likely to be institutionalized audism as society has assumptions that allow acceptance and perpetuation of this practice (Burke 2017). There are known objections to this practice, including the following: "power of the purse-strings objection, the capability objection, and the preference objection" (Burke 2017).

The purse-strings objection derives from who covers the cost for the interpreter to be given the final say. This is primarily due to the lack of funding for those ongoing requests, which is opposite to physical disability accommodations including paying personal attendant or even where an allocated fund is given to deaf people for interpreting expenses annually as done in some countries (Burke 2017; Napier et al 2020). For example, paying personal attendants is directly done by the consumer or patient with a

provided existing funding source (i.e. insurance or government-funded). However, the opposite is true where interpreting expenses are not directly paid by the Deaf consumers in the majority of the circumstances encountered, especially in the workplace. Moreover, more clarity needs to be provided regarding the type of accommodation that should be done automatically or on a request basis. While by request basis is the ad hoc approach, Scott et al (2023) point out that public events held by a post-secondary institution should have interpreters by default, since such events are open to the public and the public by definition include deaf individuals.

The capability objection is the ability to assess whether an interpreter is qualified or determine the appropriate solution to the interpreter request, which is commonly seen for requests of an interpreter team in which the Deaf scientists are often ignored and hearing individuals say one interpreter is enough. This needs to be thoroughly analyzed as this can lead to a "graded scale" giving preference authority to a group of Deaf people or in the workplace to hearing workers over deaf workers.

The preference objection comes from allowing the Deaf individual to request interpreters that they know through the Deaf community and over the years have become friends. The default position would be not to let the Deaf individual select interpreters however Burke (2017) is not convinced as the two parties (the Deaf individual and interpreter) are thoughtful and deliberate in the professional capacity in the workplace similar to what occurs in other professional relationships that can involve multiple roles.

So what are the solutions? At least to ensure the Deaf individual is given the context of the event and thus the interpreting assignment with plenty of advance notice. Determine when the Deaf individual gets the power of veto and connect this to autonomy in whatever context the Deaf individual is in (this should be negotiated in advance). This typically doesn't occur as this is not an established norm when booking an interpreter or team (involving the Deaf individual, the interpreter agency, and the entity paying for the accommodation). It is recommended that the interpreter agency (and the interpreters) take the lead in this aspect of the discussions.

Lastly, the Deaf individual must be allowed the power to choose the interpreters and whether a team of interpreters is needed. This includes deciding if the interpreter should be hired by the entity (this is called the "designated interpreter paradigm" due to the particular expertise and skillset) or go through an agency (which is usually the default mode, without consideration as this is already institutionalized) (Burke 2017). On the one hand, designated interpreters need four factors to be effective (Hall et al 2019):

- An existing pool of qualified interpreters.
- Administration buy-in at all levels.
- The funding mechanism is identified.
- There is a person responsible for functions including solving technical issues, outreach/education within the entity and advocating for the Deaf professional.

On the other hand, Hall et al (2019) describe how the agency model has hidden costs due to the time involved, productivity, misrepresentations and lack of social capital. For instance, it is known that Deaf individuals spend up to 2-10 hours a week arranging their accommodations – which is lost time towards work time or education (Hall et al 2019). In addition to the involved time effort, repeated explanations of the interpretation process and feedback to a rotating number of agency interpreters are often required in the agency model (Hall et al 2019). Similar to Young et al (2019b) and Burke (2017) the misrepresentation occurrence in the interpretation interaction increases if interpreters are found not to have the appropriate expertise and content knowledge (Hall et al 2019). To frame this, this can be a negotiation between the entity and the Deaf individual in the sense of examining expertise vs expense as an effective accommodation (Burke 2017).

As Young et al (2019b) has stated, everyone needs to be aware of a positive "relational" attitude as helpful in discourse in the workplace. So hearing colleagues of Deaf scientists may apply the following practical examples:

- Add social information to your work emails to Deaf colleagues.
- Use of emoticons in text-based conversations.
- Maintain eye contact with your Deaf colleague even though the source of the language comes from another body (i.e. the interpreter).
- Make small talk in informal spaces.
- Introduce shared humour implicit or obvious between the hearing and deaf individuals.

Additionally, the interpreting process and its nuances need to be understood by deaf students (Knox 2006). In doing so, the deaf student understands when it is appropriate to adjust or improve the process so that the interpreting effectiveness is better or improved (Knox 2006). It is to their advantage that faculty, lecturers, or instructors consider the ways deaf teachers approach their lessons and incorporate them into their teaching or research (Knox 2006; Weber & Skyer 2022; Weber et al 2025). Intercultural communication facilitated by interpreters is best approached when the interaction between students and teachers is respectful (with less emphasis on power mechanisms existing in such relationships) (Knox 2006).

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