PRODUCT DESIGN EDUCATION FOR DEAF & HARD OF HEARING LEARNERS: EXAMINING THE FOUR-YEAR UNDERGRADUATE LEARNERS EXPERIENCE

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ABSTRACT
Deaf and Hard Of hearing (D/HOH) learners face unique challenges on a day-to-day basis, especially in a higher education environment. Consider being D/HOH over the past four years in higher education having to contend with distance learning, socially distanced learning, and face to face learning. These differing environments and teaching methods require a range of setups. The variability in methods/types of teaching within Product Design Education means there are various challenges to overcome. Accessibility and disability considerations differ from student to student and thus require a significant amount of planning and testing for academic teams to ensure D/HOH learners gain access to the same quality and consistency of education as other students do, regardless of the setting. This paper presents a case study examining the four-year learning experience of a student with Auditory Neuropathy Spectrum Disorder (ANSD) and permanent bilateral severe-profound hearing loss who studied BSc (Hons) Product Design SW at Nottingham Trent University. This included a placement/year in industry at Kinneir Dufort (KD) as a Product Design Intern. We reflect on the education adjustments designed into the course curriculum which have benefitted all students, whilst summarizing/reflecting on the support provided for applying for placements ensuring a successful placement/internship can be secured. Observations on the placement application process and work experience will be present highlighting the necessary adjustments made in relation to the access to work guidelines. A student testimonial of their learning journey is presented reflecting on their educational development and support systems.

Keywords: Accessible learning, collaborative/cooperative learning, deaf/hard of hearing learners, design education, year in industry

1 INTRODUCTION & CONTEXT
Over the past four years, students in higher education (HE) have faced numerous challenges, most notably due to the impact of the COVID-19 pandemic and the migration of all learning, teaching, and assessment into online domains [1]. Post COVID-19 pandemic adjustments to the integration of digital learning that has remained [2], and with the return to face-to-face teaching, students often weigh up the value of face-to-face teaching compared to hybrid and online approaches [3]. However, imagine being a D/HOH learner studying a creative course such as BSc Product Design SW, having to study under all three learning arrangements and having to navigate the ever-changing teaching/learning settings; difficult to say the least. D/HOH learners have faced many challenges over the past four years as identified in our previous case study [4]. However, the impact of COVID-19 on D/HOH learners extends beyond the pandemic, with many adjustments post pandemic needing consideration. The National Deaf Children's Society identified that deaf children and young people have suffered from language stagnation or language loss, inaccessible education, and additional social, emotional, and behavioural challenges both during and post pandemic [5]. The inability of some in the hearing academic community to understand, comprehend and empathize with D/HOH learners has been problematic [6].
Studying product design (PD) often requires teamwork and collaboration, which can be problematic for students with hearing impairments to feel fully integrated. To create an inclusive and collaborative working environment adjustments must be made, in the teaching environment, through the use of digital technologies, or via peer-to-peer/tutor communication considerations. Managing the stigma associated

with D/HOH learners in different settings [7] often means that students and staff must be appropriately educated when considering the overall learning experience. This paper discusses the successes and challenges of methods of managing the PD teaching environment in combination with the use of electronic/handwritten notetakers, British Sign Language (BSL) interpreters, and the accompanying technologies across a four-year period where online learning, blended learning and face to face delivery were all a part of the learner's experience. This paper follows-up our previous case study where we reviewed the successes and challenges from the first year of supporting PD education for D/HOH learners during a pandemic [4]. This paper holistically reviews the four-year undergraduate journey, which included a placement year in industry, reflecting on the impacts of our teaching and course design, but also the placement/year in industry arrangements. Creating an inclusive education and work environment to support D/HOH learners in the PD sector requires a proactive approach. Factors ranging from promoting a supportive inclusive learning community, to integrating/embracing the network of specialist support staff must be considered if an inclusive work environment that covers the necessary access to work arrangements available to all of the D/HOH community is to be achieved.

2 FOUR YEAR COURSE OVERVIEW

The D/HOH student enrolled onto BSc PD; this course is designed to allow students to immerse themselves with engaging lectures, seminars, workshops, and design studio sessions. The standard structure for the first/second year consists of two days based in the design studio, supported by design sketching, CAD, and electronics vocational workshops. 3D printing, mechanics, design context/history and workshop appreciation taught sessions are also integrated. Students leverage our virtual learning environment, NOW (Nottingham Online Workspace), for self-directed projects which promotes independent study including, researching, completing coursework, and curating design portfolios. Students benefit from external professional practitioners, ensuring a continual enhancement of learning with real-world perspectives; placement support and professional practice development is also embedded. During the third year the D/HOH student was enrolled onto a 12-month industrial placement at KD. The fourth year consists of a commercial project, a self-directed project, and a dissertation/thesis supported by a lecture series, one to one/group tutorials, and computer aided design sessions.

3 LEARNER TIMELINE & ARRANGEMENTS

This case study focusses on a D/HOH student who has Auditory Neuropathy Spectrum Disorder (ANSD) and permanent bilateral severe-profound hearing loss. They joined BSc PD at Nottingham Trent University (NTU) in September 2020 during the height of the COVID-19 pandemic and studied fully online during their first year, in a blended learning environment during their second year, conducted a year in industry with no restrictions in their third year and studied in a fully face to face environment during their fourth year. The learner's needs were defined by a statement of access (SOA) which was updated annually. This identified that the student wears hearing aids in both ears due to hearing loss (Deafness), requiring timetabling in rooms with induction loops and transcripts produced for all audio-visual material. Environmental factors needed considering as the student uses radio aids requiring lecturers to wear a supporting microphone. British Sign Language (BSL) interpreters are utilised in all formal learning environments requiring lecturers to speak at a reasonable pace for accurate translation. Notetakers were arranged for all sessions. To aid the planning/delivery of sessions, the student was provided with specialist one-to-one support including a specialist notetaker for HOH students (448 hrs/yr.), a specialist support professional for HOH students (36 hrs/yr.) and a BSL Interpreter (840hrs/yr.). The full learner's arrangements are discussed in our previous case study [7].

3.1 Face to Face Academic / Course Arrangements

Building upon the key course arrangements that were previously discussed for the first year of studying BSc PD online/blended [4], this section highlights the additional teaching and learning arrangements put in place for the second year and final year studies that took place in a blended and face to face setting. In-person design studios were again possible post COVID-19 pandemic, as such adjusting to an in-person delivery of a practical subject was key. The daily ordering of activities was important in order to facilitate D/HOH student optimal concentration times. Resources required meticulous planning with all presentations/resources needing to be 100% accessibility compliant with all images requiring ALT text. Activities needed to be ordered appropriately to ensure that the D/HOH student was able to maintain concentration appropriately throughout the day. A minimal number of pre-recorded self-directed study

activities were utilised, however when used they required full captions with supporting worksheets that helped facilitate student comprehension of subject topics, skills, and software literacy. Group work was limited to five people apart from the larger design sprint events to facilitate optimal learning environments. For design sketching and CAD sessions, these were now 100% face to face, as such the teaching spaces were set up the student's visual access of presentations, but supported with a BSL interpreter and notetaker who were strategically positioned for optimal communication. For computer-work, dual screen setups were provided for efficiency, with the D/HOH student positioned opposite the tutor for necessary adjustments. Electronics learning, now in person, featured live and pre-recorded content. One-to-one's/technical support was offered when complex circuitry/coding taught. Tailored placement support was provided in the second year to ensure that accessibility factors were considered. A dedicated employability team provided one-to-one support. Studios/lecture theatres had hearing loops, lecture capture/recordings, and audio adjustments. Virtual Learning Environments were configured for accessibility, providing relevant access for preparatory work to BSL interpreters and Notetakers.

For the final year, project supervision and dissertation/thesis support was introduced. Traditional lectures were reintroduced at final year for research methods/design and dissertation/thesis writing. The D/HOH student chose to pursue a dissertation route that addresses an area of controversy or point of debate within design. Taught aspects included a combination of a lecture series and ten individual supervisions. To support access to content, several strategies/resources were deployed, the most notable being ensuring that BSL interpreters and notetakers were present for lectures. Crucially, it was learned that both interpreter and notetaker required all the supporting resources for a given lecture at least 24hrs in advance to provide time for the BSL interpreter to identify words that do not currently have a sign attributed to them, and for the notetaker to read over the lecture slides to prepare fully and reduce pressure during lectures. Further improving these adjustments was the consistency of personnel; working with the same BSL interpreter/notetaker proved vital for content planning/delivery. As previously mentioned, the BSL interpreter was positioned at the front of the lecture theatre where they could be seen easily and the lecturer was instructed to deliver the content from the lectern without moving across the stage, so as to not impact lip reading. A number of drop-in sessions where students can engage with group seminars, peer reviews, tutor support and independent writing was also offered.

3.2 Placement/Year in Industry Arrangements

Many factors needed to be considered during the process of recruiting/hiring, working, and supporting a D/HOH employee. For KD, the recruitment process to accommodate for a potential D/HOH consisted of ensuring flexibility in terms of interview location. We were willing to learn how we can better our recruitment process to accommodate D/HOH individuals. Prior to the D/HOH student's application, the recruitment process/interviews were held online. To KDs benefit, the D/HOH individual was vocal about being Deaf, therefore KD adjusted the interview process. KD accommodated the in-person interview request to ensure the applicant felt comfortable to perform at their best. A new expenses policy was introduced following the D/HOH applicant's request to hold the interview in person, to cover travel to KD for interns, graduates, and junior interviewees travelling from outside of Bristol. Another key insight that came from the recruitment process was that KD are usually inclined to communicate via the phone. However, learnings from the D/HOH applicant enabled us to understand why this may not always be a suitable method of communication for everyone and we make adjustments when needed.

Once the D/HOH intern was hired, KD wanted to ensure that all arrangements were put in place to provide an authentic intern experience. All interns are paired with a mentor, usually a junior member of staff from the same team. This enables the interns to have the space to talk openly/freely and have the opportunity to address positive and possibly uncomfortable situations with the support of someone not too senior, which we understand can often be more daunting when being new in the industry. We see it as incredibly important for everyone to have that relationship with someone in the business. Allowing our interns the space to build a relationship with our more junior members allows them to ask questions more openly, and helps our junior members build confidence in speaking about learnt experiences. KD tend to ensure that we hire more than one intern for each year which gives interns a cohort of immediate peer support. Interns are tasked with an introductory non-client facing project in the first weeks of their internship. This helps interns get to grips with KD's way of working with access to support from other members of staff with the freedom to learn, and opportunity to make mistakes. All interns have an informal 4-week and 6-week check, and a formal 3-month and 6-month progress check.

KD made a number of adjustments; one key factor was to immediately address Health & Safety (H&S). For example, our fire alarm system was not appropriate for D/HOH individuals. We therefore introduced a suitable fire alarm system that is a lot more inclusive. During the D/HOH interns time at KD we were very involved in the process of supporting their hearing dog application, introducing adjustments such as giving the intern a dedicated space where they could be located, whilst ensuring they could sit within our usual hot desking setup. KD were also very keen to help other employees understand what adjustments were needed when working with D/HOH individuals. This was something that the D/HOH intern was very open to support, being very vocal about the D/HOH. We also want to address some things that did not go so well to acknowledge that it's not all smooth sailing. One example was the KD companywide meetings, which due to Covid, are still mostly held remotely. It's still common that individuals can forget to turn on their cameras when speaking during these calls, which we are aware is difficult for D/HOH individuals. As such we now encourage our meetings to be held in person, or where not possible, ensure everyone is aware of the MS Teams etiquette that accommodates D/HOH individuals e.g. turning cameras on when speaking, good lighting, facing cameras etc.

The Access to Work government scheme/adjustments application was led by the D/HOH intern, with KD providing the necessary information. Going through the process of answering specific questions about our accessibility as a company for D/HOH individuals was a useful process that helped us assess where we sit in terms of accessibility and being able to support D/HOH individuals. This made it an incredibly easy process to know what needed to be changed to accommodate D/HOH individuals, but it is critical to learn from each individual what their specific needs are. It was helpful that the Access to Work scheme gave the D/HOH intern access to a BSL resource, although we only required them once. It is worth noting that, as far as we are aware, the D/HOH intern was the first employee at KD that was Deaf, therefore a lot of this was a learning process, and we are grateful to the D/HOH intern for being a real voice for the D/HOH community. We are now better equipped to accommodate individuals, although there are still things we need to improve on, and overall, we're keen to reiterate that employing a D/HOH individual is not a complicated process; had we shied away from hiring the D/HOH intern, we would have missed out on an incredible design talent that was an asset to KD.

4 ACADEMIC & EMPLOYER PERSPECTIVES & REFLECTIONS

Further to our previous reflections on the first year of studies conducted in an online/blended environment [4], further learning opportunities can be highlighted for in person learning. While accustomed to collaborating with support services across NTU to address student learning adjustments, our experience working with the disability team continued to be beneficial. Consistency of British Sign Language (BSL) interpreters proved challenging at times due to enforced changes at the institutional level. Based on availability/constant changes in arrangements/processes, BSL services were challenging to manage for staff/student. After a difficult second year and based on feedback, NTU changed its approach to hiring BSL's; recruitment became personalised to everyone's needs. Consistency in the support services and facilitates is key for session planning/delivery to normalize the learning environment. Insights provided by support teams enhanced our understanding of learning/educational challenges faced by D/HOH students and made the process of preparing course materials more effective. The working arrangements with BSL's and notetakers was different in the final year, with cross course traditional lectures and writing workshops provided. Individual tutorials for dissertation support were setup/aligned to the student's personal tutor for consistency. Room planning was critical; several room changes were made to accommodate noisy surrounding environments. One-to-one support for dissertation supervision was simple to arrange with only the notetaker being required. Each tutorial was recorded for notetaking accuracy with additional one-to-ones arranged where required.

Interns give KD a fresh perspective from someone entirely new to the industry. We value having mixed experience teams; interns key to this. We pride ourselves on our mentor/mentee relationship, especially between our interns/junior members of staff. Our interns create a valuable future employee candidate pool. KD are always incredibly excited to welcome back past interns into junior positions following graduation. One of the most valuable effects following supporting a D/HOH employee is KDs new/improved adjustments to our style of working/work environment, but also each employee's individual awareness and learnings of ways of interacting/ ways of working to accommodate everyone. KD pride ourselves on our people, therefore psychological safety and considering our employees welfare is incredibly important. Understanding the importance of having safe spaces for potentially vulnerable employees is key. Establishing a mentor/mentee relationship is critical/valuable; this allowed KD to

build to learn what adjustments are needed to create safe space for all. This has further improved our openness to accommodate flexible working practices. It is incredibly important to understand how we can best support someone to ensure they can present themselves in the best/most comfortable way.

There are many key learnings that KD have taken away from supporting a D/HOH employee/intern. The most important was taking the time to understand the standard ways of working and etiquette for all individuals; both in person and remotely. As a company we did not find it complicated to introduce adjustments for D/HOH individuals, although some may assume it is. Although specific adjustments had to be made, many of these are still in place, even though the D/HOH interns' placement is now finished. This makes it an even easier process for any individuals in the future to be fully integrated into KD, especially D/HOH individuals. We have also gained really valuable insights into what is more difficult to adjust for in terms of any future employees. We also picked up on bigger issues that we are keen to explore and address, for example, our office is a Grade 2 listed building which makes big structural changes more difficult – and there are some things we cannot do. In the case of D/HOH employees, we have seen how minor adjustments can have a huge difference to someone's experience, and the process of making those adjustments, in most cases, is incredibly easy.

5 LEARNER PERSPECTIVES & REFLECTIONS

The COVID-19 pandemic posed many challenges during the first year of study due to the increased use of masks [4]. Academics/support services ensured the availability of 1-1 sessions to address missed information/clarify new content (e.g., workshops/electronics). Peer selection for group tutorials/projects involved identifying students with familiar accents from friendship groups, enhancing familiarity/work progress. When specialist sessions were arranged, I was able to select the relevant academic staff to provide support, for example I was able to pick my dissertation/project supervisors for my final year. Having the same personal tutor throughout my degree ensured familiarity and ongoing support, making it easy to address concerns. NTU provided the opportunity for me to book extra BSL support for external trips i.e. for factory visits. Additional services i.e. employability provided a supportive environment whereby sensitive questions around the perceptions of my disability to employers could be addressed. They advised on establishing a position in the sector with a strong Deaf identity, a non-negotiable factor in selecting future employers. NTU was open to having an assistance dog on campus supporting the application process. Challenges faced included managing BSL interpreters/notetakers bookings which added an extra workload. Even with timetables published in advance, and academics liaising with external support services, student approval was still required. As many initiatives as possible were made fully accessible, some student led initiatives were not always as accommodating, such as a student curated video podcast series, where captions were not provided, and funding fell outside of the scope of accessible provisions. This unfortunately created barriers/inaccessibility for the D/HOH community.

When applying for the internship at KD an in-person interview (originally scheduled to be online) was made available. Beforehand, a provided telephone number allowed for sending a text message in case of travel delays. Once at KD, a workplace mentor was provided creating a unique partnership whereby they had an increased sense of deaf awareness, allowing them to advocate on my behalf (with permission). Weekly mentor check-in sessions were completed, alongside 3-month and 6-month reviews. The workplace culture meant everyone was approachable, from the Head of Design to the CEO. KD's workplace culture enabled me to maximize my placement experience; KD's support allowed me to really focus on the work that I was doing, rather than having to worry about access. This made it easier for me to ask people if they could repeat themselves or turn on a light so lipreading could take place when on MS Teams. KD provided me opportunities to explore areas of passion allowing me to share my own lived experience internally/externally. As such the experience allowed for my attendance of an EDI conference, engagement with Inclusive Design Workshops (Lunch and Learn) and Inclusivity Initiatives whilst allowing me to write press releases for Deaf Awareness Week about my experience as a young Deaf designer. KD supported the application of getting an assistance dog (Hearing Dogs for the Deaf) during the internship, allowing the Hearing Dog team to complete an assessment of the workspace.

6 DISCUSSION, CONCLUSIONS & RECOMMENDATIONS

Previously we identified numerous support mechanisms to consider when supporting D/HOH learners in online or blended learning environments [4]. Various factors include learner environment, communication strategies, flexible assessments, technology integration, collaboration with support services, personalised feedback, peer support, and professional development. The most important factors

to consider are inclusion, diversity, and cultural sensitivity. Factoring in arrangements that are not only culturally sensitive, but diverse to accommodate all learners is critical. We've encountered various arrangements, collaborating with external suppliers/charities like hearing dog charities, BSL providers, and notetakers. Collaborating with external agencies can pose challenges due to the time needed to organize/deploy support staff. While it may not easy due to the advanced timescale required for implementing the support, effective communication and coordination among the right team and administrators can resolve any issues or delays. Acknowledging the unique preferences and requirements of each student is crucial. Within an academic environment, exploring various strategies used for D/HOH students with differing degrees of deafness would be an intriguing aspect to examine. Through employing a D/HOH intern KD have developed greater understanding/approach to supporting people's individual needs. It is important to listen and create spaces in which people feel comfortable to share what works and does not work well. This creates a work environment/culture that works for everybody ensuring no one gets left behind or struggles. By working closely together, KD have learnt some key lessons but also understood what we still need to address to accommodate not only D/HOH employees/interns/clients, but also others with additional needs ensuring inclusive ways of working and appropriate environments can be created. Seeing the possibility of change and the impact small adjustments have made has enabled us to improve for not only D/HOH individuals, but also our wider team. There are things that are more difficult than others to address, but overall companies should never shy away from employing an individual because of an impairment. It is the company's own doing and reluctancy to accommodate any reasonable adjustments that makes it difficult for an individual to perform. KD have a responsibility to ensure we are accessible for everyone, this not only supports our current/future employees, but also diversifies our team enabling even better work to be produced.

Educators new to supporting D/HOH individuals can learn valuable lessons. Some insights are simple, like ensuring accessibility of course materials, videos, and online content. This includes using captions/transcripts and visual aids to enhance comprehension when verbal/BSL communication lacks context. The importance of one-to-one support, personal tutoring/mentoring and collaborative working alongside BSL and notetaking support services is critical. In the last four years, we worked with four BSL interpreter suppliers and one consistent notetaking service. Maintaining consistency is crucial for effective information exchange, but support service providers' processes can pose challenges. Support providers offering flexibility and personalization enhance the D/HOH learners' experience. Those that do not, create additional challenges/barriers for learners/academics. Every D/HOH student is unique and has individual needs/requirements dependent on their condition. To conclude, academic staff/industry professionals working with the D/HOH learner have been empowered by the experience of supporting D/HOH learners but acknowledge that improvement in teaching and industry interactions can always be made. The recommendations, successes, and challenges identified are now integrated as best practices within NTU and KD to enabling optimal learning, teaching, and working methods.

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