

FACULTY PERSPECTIVES ON INTERPROFESSIONAL COLLABORATIONS BETWEEN OCCUPATIONAL THERAPY AND INDUSTRIAL DESIGN: A QUALITATIVE ETHNOGRAPHIC INQUIRY

Kimberly Mollo¹ (BFA, OTD, OTR/L), Madalyn Peterson² (OTD,
OTR/L), Rebecca Brown² (OTD, OTR/L)

^{1,2,3} Department of Occupational Therapy, Thomas Jefferson University,
Philadelphia, PA, USA

¹ ORCID: <https://orcid.org/0000-0001-6519-4633>

¹Kimberly.Mollo@jefferson.edu, ²Madalyn.Peterson@jefferson.edu,

³Rebecca.Brown@jefferson.edu

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Abstract: Incorporating a user-centred approach to universal design solutions improves functionality and access for a more diverse group of individuals to engage with end products within everyday environments successfully. Interprofessional collaborations between industrial design and occupational therapy are one approach that integrates a user-centred universal design perspective throughout the design process, as occupational therapists have unique expertise in understanding how individuals participate in activities and engage with everyday products and environments.

This qualitative ethnographic inquiry explored faculty perspectives (n=5) involved in interprofessional academic collaborations between design and occupational therapy at the university level in the Northeastern United States. Five themes emerged: 1) “Benefits of Collaboration:” Improving the Design Process; 2) “Benefits of a Mutual Approach:” Supporting Design Learning; 3) Interprofessional Awareness and Education Approaches “Help and Hinder” Collaboration Efforts; 4) Benefits and Challenges to Accessing: “Navigation of the Obstacle Course”; and 5) “Minding the Gap:” Professional Education and Training. Findings suggest that interprofessional collaborations between

occupational therapy and industrial design via an embedded model positively impact design outcomes and influence student and faculty learning during the design process, clarify educational objectives, and prepare student industrial designers for future professional practice.

Keywords: occupational therapy, interprofessional collaboration, interprofessional education, student, user-centred design.

Introduction

Disciplines such as industrial design and occupational therapy have become increasingly aware of the need to develop and explore collaborative methods and processes that mutually forward both professions' ability to advance and serve their users and clients (Mollo & Avery, 2017; Amiri, Wagenfeld, Reynolds, & 2017). In the industrial design profession, a "user" can be defined as the individual who experiences and engages with an object, product, or environment (McDonagh & Thomas, 2013). In the occupational therapy profession, "clients" are defined as individuals whose active participation in daily activities is impacted by illness or disability, limiting well-being and ability to fully engage in society (Schell, Gillen, & Scaffa, 2014).

In clinical practice scenarios, occupational therapists treat individuals throughout the lifespan. They complete intake interviews, evaluate performance using skilled observation, apply clinical reasoning, implement standardized testing procedures, and deliver interventions based on scientific evidence (American Occupational Therapy Association [AOTA], 2020). Occupational therapists use, modify, or both, available fabricated objects, products, and built environments created by industrial designers to better ensure active meaningful engagement and independence in daily tasks and activities to the extent possible (Murphy, Panczykowski, Fleury, & Sudano, 2020). On the front end, industrial designers support users (and occupational therapists) by developing and integrating universal design solutions that aim to address user needs and improve the lived experience when interacting with objects, products, or the environment for as many individuals as possible

(Amiri, Wagenfeld, & Reynolds, 2017; De Couvreur & Goossens, 2011; Young, Wagenfeld, & Vander Veen Rocker, 2019).

Many industrial designers are now employing participatory design, user-centred design, and co-creation practices, which involve the active inclusion of users and other stakeholders to identify, understand, and address user needs during the iterative design process (Sanders & Stappers, 2014). Emerging research in the design professions indicates that it is critical to incorporate the user perspective to achieve successful functional and universal end products and environments (Boman, Nygard, & Rosenberg, 2014; McDonagh & Thomas, 2013; Medola, Sandnes, Ferrari, & Rodrigues, 2018). An effective way to obtain this type of input during the iterative design process is through interprofessional collaboration, a common approach employed in healthcare settings and education (Reeves et al., 2016). Wagenfeld, Reynolds, & Amiri (2017) noted that 33% of occupational therapists had worked in an interprofessional design project and 31% of designers had worked with occupational therapists; 88% of the occupational therapists who had participated in these types of interprofessional experiences reported the desire for more opportunities for interprofessional collaboration. Prior documented partnerships between occupational therapy and industrial design suggest interprofessional collaboration enhances user-centred solutions in design; however, the amount of literature specifically describing collaboration in educational and/or professional settings remains limited (Lee, 2016; Young, Wagenfeld, & Vander Veen Rocker, 2019).

Background

In 1986, Norman and Draper introduced the term user-centred design as “the need for a design that uses the natural properties of individuals...focusing on the needs and interests of the user, in order to make the final products usable and understandable” (as cited in Luna et al., 2015, pg. 967). Design professionals have incorporated user-centred approaches in design practice to increase idea generation, decrease the number of revisions required in the iterative process, and increase the usability for individuals who will experience and engage with the end product (Lee, 2016; McDonagh & Thomas, 2013; Medola et al., 2018; Veryzer & Borja de Mozota, 2005). Early principles

of user-centred design led to the development of emerging design philosophies intended to increase the direct relationship between users and designers; these include participatory design, co-creation, co-design, and “Design for All” (Bucchianico, Gregori, & Rossi, 2012; Sanders & Stappers, 2008; Tseklevs & Cooper, 2017). In these approaches, designers, scientists, engineers, programmers, doctors, psychologists, or nurses incorporate users into the academic and/or design research experience as collaborators, rather than inspirations, to capitalize on the users’ lived experience and inform solutions to complex day-to-day issues impacting participation in daily activities and experiences with end products and services (Driver, Peralta, & Moultrie, 2011; Hu, Hu, Lyu, & Chen, 2021; Orfield, 2018; Sanders & Stappers, 2008). With user-centred design methodology, design professionals and co-collaborators from a variety of backgrounds have produced positive user outcomes for a range of end products and services, such as videophones for individuals with dementia, assistive devices and technologies, web-based decision aides, outpatient oncology facilities, as well as other personal health tools (Bogza et al., 2020; Boman, Nygard, and Rosenberg, 2014; Carmel-Gilfilen & Portillo, 2016; De Couvreur, Detand, Dejonghe, & Gossens, 2012; Orfield, 2018; Vaisson et al., 2021).

While user-centred design approaches bring designers closer to human-centered universal design solutions, there continues to be a gap in designers’ existing knowledge of users’ needs and the translation of these needs into sufficient solutions (Ielegems, Herssens, & Vanrie, 2016; Kim, Liu, & Joines, 2015). Designers’ and organizations’ self-identified barriers to applying user-centred approaches included lacking expertise in communicating with users and limited access to user populations (Carmel-Gilfilen & Portillo, 2016; Hu et al., 2021). Another barrier explored was the user’s direct access to contribute to the design process, for reasons such as cognitive decline and decreased verbal skills (Orfield, 2018). Under these circumstances, other stakeholders supplemented or captured the views of the individual (Boman, Nygard, and Rosenberg, 2014).

An identified solution to address these barriers is to develop multidisciplinary design teams and practice via interprofessional collaboration (Boman, Nygard, and Rosenberg, 2014; McDonagh & Thomas, 2013; Watchorn et al., 2019).

Interprofessional teams help to improve collaboration as professionals share multiple viewpoints and enhance knowledge to increase innovation (Larkin, Hitch, Watchorn, Ang, & Stagnitti, 2013; Pirinen, 2016; World Health Organization, 2010). When creating products with interprofessional team members that work closely with the intended users, designers develop an increased awareness of users' needs, identify "pain points" or problem areas that impact user experience more quickly, and have greater access to testing populations, which can allow solutions to have increased user adoption rates and universality (McDonagh & Thomas, 2013; Silver, Binder, Zubcevik, & Zafonte, 2016; Wagenfeld, Reynolds, & Amiri, 2017).

More recently, findings indicate it is beneficial for designers to collaborate with healthcare providers to address health-specific problems related to chronic conditions or ageing in place (McDonagh & Thomas, 2013; Wagenfeld, Reynolds, & Amiri, 2017; Young et al., 2019). Occupational therapy serves as a healthcare profession with a unique skill set to enhance the design. Occupational therapists can demonstrate value to the design process by being able to promote understanding of client factors and function for the diversity of users and support understanding for designers as to how people living with all types of physical and mental health conditions can and do participate effectively in everyday life and when interacting within their environments with the proper support (Amari, Wagenfeld, & Reynolds, 2017; Hitch, Larkin, Watchorn, & Ang, 2012; Lee, 2016). They also contribute knowledge to designers about how health products are used and distributed to individuals with disabilities (Lee 2016; Medola et al., 2018; Wagenfeld, Reynolds, & Amiri, 2017). Evidence suggests that in-depth knowledge of user needs and health conditions can support effective design (lelegems, Herssens, & Vanrie, 2016), with the most successful user-centred design solutions designed for universal access (Hitch et al., 2012; Buccianico, Gregori, & Rossi, 2012; Watchorn et al., 2019). Some documented examples of effective interprofessional collaborations between occupational therapy and industrial design include the development of a videophone for adults with dementia and user-specific products such as glasses for an adult with ankylosing spondylitis (Boman, Nygard, and Rosenberg, 2014; De Couvreur et al., 2012; McDonagh & Thomas, 2013; Young et al., 2019).

Interprofessional collaborations between occupational therapists and industrial designers are emerging in recent literature (Hitch et al., 2012; Wagenfeld, Reynolds, & Amiri, 2017; Young et al., 2019). Available literature acknowledges that barriers such as biases, misperceptions, and lack of resources impact the initiation of professional collaborations (Dong, 2010; Larkin et al., 2013; Wagenfeld, Reynolds, & Amiri, 2017; Young et al., 2019). One proposed solution to address these barriers is to incorporate increased interprofessional collaborations between these professions at the academic level in order to address misconceptions and embed a collaborative way of thinking from the onset of professional training (Larkin et al., 2013; Wagenfeld, Reynolds, & Amiri, 2017; Young et al., 2019). To support an increase in collaborations at the university level, evidence suggests further research is necessary to incorporate outcome measures that capture a broader perspective of student learning and document novel curricular methods applied during interprofessional experiences. (Dong, 2010; Larkin et al., 2013; Hu et al., 2021).

Methodology

The development of this qualitative ethnographic inquiry was formulated around available anecdotal evidence from previous user-centred, co-creative, participatory design interprofessional collaborations occurring at Thomas Jefferson University in the Northeastern United States, which were modelled to embrace emerging trends in design focusing on healthcare's role in user-centred solutions (Bucchianico, Gregori, & Rossi, 2012; Silver, et al., 2016; Sanders & Stappers, 2008; Tseklevs & Cooper, 2017; Veryzer & Borja de Mozota, 2005). Current literature presented earlier in this paper accounts for student and professional perspectives within occupational therapy (Larkin et al., 2013; Mollo & Avery, 2017; Brown et al., 2021; Wagenfeld, Reynolds, & Amiri, 2017). To date, faculty perspectives and insights gleaned from these types of interprofessional collaborations remain underrepresented (Dong, 2013; Hu et al., 2021).

This qualitative ethnographic inquiry aimed to capture faculty members' experiences and perspectives from prior and current implementations of

interprofessional collaborative opportunities between occupational therapy and industrial design students at Thomas Jefferson University in the Northeastern United States. Identifying barriers and defining which collaborative learning experiences and processes were successful can help to identify, clarify, and focus on educational objectives and prepare industrial design and occupational therapy students and their faculty to participate in future interprofessional co-creational engagement experiences beyond academia into the professional realm where products are brought to market (Dong, 2013; Hu et al., 2021).

Embedded teaching and learning coursework model

Collaborative opportunities between industrial design faculty and occupational therapy faculty have been ongoing between respective departments at Thomas Jefferson University since 1999. Experiences have ranged from short one-week intensive collaborative problem-solving experiences to three-month semester-long projects where students and faculty worked together interprofessionally to create a product that improved access for a user with a disability or illness or to support populations experiencing a health condition that limited access to the environment.

In 2018, the duration of the collaboration experience was expanded. Over the course of one academic year, two third-year doctoral-level occupational therapy (OTD) students were embedded in an industrial design curriculum alongside 18 first- and second-year master's industrial design (MSID) students, three industrial design faculty, and one occupational therapy faculty to provide on-going, embedded opportunities for aligned learning and collaboration. Both OTD students attended and participated in MSID courses, studios, and field experiences. To support interprofessional awareness and education, the OTD students developed and executed educational modules for MSID students, which included pertinent content on health conditions, experiential learning activities using adaptive medical equipment within context related to individual function and participation associated with illness and diagnosis, interdisciplinary perspectives on the comparison and application of occupational therapy and design theories, and task/activity analysis—methods utilized by both professions independently to breakdown

steps required to complete a task or activity. To further enhance the interprofessional collaborative experience and to improve interprofessional awareness of the other, the OTD and MSID students also completed individual and group design projects, including, but not limited to, the development of a toy/game, creation of a product to support the needs of a caregiver for an individual with a chronic health condition, and problem-based learning for various other non-health-specific design issues. Detailed and technical information about the specific components occurring in this expanded educational experience and subsequent products created is available in a previous article published by the authors; refer to Brown et al., (2021).

Data collection

A 45-minute semi-structured interview consisting of six open-ended questions explored occupational therapy and industrial design faculty perspectives on previous and current academic design collaborations experienced between occupational therapy and industrial design students at undergraduate and graduate curricula levels (*Table 1*). Faculty were recruited by the two OTD students via email in January at the start of the spring semester. All interviews were audio-recorded with consent and data were de-identified to protect privacy.

Exempt approval was obtained by the university’s IRB board; all questions were piloted to confirm clarity of intent and reviewed by the occupational therapy department chair and two university faculty outside the fields of industrial design and occupational therapy.

Table 1: Semi-Structured Interview Questions.

Question 1:	How did you find out about this collaboration? What about it intrigued you?
Prompt:	<i>[for industrial design faculty]</i> Why partner with occupational therapists?
	<i>[for occupational therapy faculty]</i> Why partner with design?

Question 2:	What I am trying to uncover are the benefits and obstacles associated with embedding occupational therapy doctoral students in design curricula. I am interviewing faculty members to understand their perspective and experience within these collaborations. What do you see as the benefits, if any, of collaborations between occupational therapy and design students?
Prompt:	Do you think there are any gaps [<i>in your profession/in society</i>] that a collaboration of this type/nature fulfills?
Question 3:	As an instructor, have you noticed any changes in student performance and outcomes throughout this collaboration?
Prompt:	If so, what changes? Can you give any examples?
Question 4:	In your opinion, compared to past years' projects, has this year's collaboration impacted the outcomes of your design project(s)?
Prompt:	Can you tell me more about the specific projects you are thinking of? In what way were they impacted?
Question 5:	Are there any on-going barriers preventing successful collaborations between occupational therapy and design?
Prompt:	If yes, can you elaborate?
	What are your suggestions to address any issues you just identified?
Question 6:	If you could envision an ideal interprofessional collaboration between occupational therapy and design, what would that look like?
Prompt:	What are your thoughts about these types of collaborations in the short-term vs. the long-term?

Participants

Convenience sampling was used to identify three (male) industrial design faculty participants (with 5 years, 11 years, and 20 years of teaching experience), and two (female) occupational therapy faculty participants (with 4 years and 35 years of teaching experience) who had previous or current experience with interprofessional design collaborations at the university.

Data analysis

Data analysis was completed using NVivo 12 software. Audio recordings of each interview were manually transcribed and cross-verified by investigators. Observations and interpretations taken during and after each interview were noted with NVivo 12 to maintain an audit trail. Transcribed interviews were coded, resulting in the emergence of five overarching themes and 15 sub-themes (*Table 2*).

Results

Table 2: Themes and Subthemes.

Theme 1:	“Benefits of Collaboration:” Improving the Design Process
Subthemes:	<p><u><i>1.1: Defining the user and understanding user complexity</i></u></p> <p><u><i>1.2: Supporting research process & assisting in contextualizing findings</i></u></p> <p><u><i>1.3: Supporting problem identification & design direction</i></u></p> <p><u><i>1.4: Developing skills necessary for professional success</i></u></p>
Theme 2:	“Benefits of a Mutual Approach:” Supporting Design Learning
Subthemes:	<p><u><i>2.1: Defining the interaction as embedded</i></u></p> <p><u><i>2.2: Consistent access changes attitudes</i></u></p> <p><u><i>2.3: Ability to effectively engage in increasingly complex design challenges</i></u></p> <p><u><i>2.4: Embedded collaboration model aligns well with teaching model</i></u></p>
Theme 3:	Interprofessional Awareness and Education Approaches “Help and Hinder” Collaboration Efforts

Subthemes:	<p><u>3.1: Collaboration vs. teamwork vs. cooperation</u></p> <p><u>3.2: Overlap of language, processes, and theories</u></p> <p><u>3.3: Importance of recurring awareness sharing</u></p>
Theme 4:	Benefits and Challenges to Accessing: “Navigation of the Obstacle Course”
Subthemes:	<p><u>4.1: Barriers to access</u></p> <p><u>4.2: Lasting professional alliances</u></p>
Theme 5:	“Minding the Gap:” Professional Education and Training
Subthemes:	<p><u>5.1: Design training in integration of concepts and users</u></p> <p><u>5.2: Occupational therapy training in device design & object use</u></p>

Theme 1: “Benefits of Collaboration:” Improving the design process

Situated in the context of industrial design curricula, and concurrent with recent findings suggested by Watchorn et al., (2019), Young et al., (2019), and Murphy et al., (2020), industrial design faculty consistently reported that on-going collaboration with occupational therapy students provided a level of expertise that improved the design process at various stages. The faculty noted that, in comparison to other healthcare experts, occupational therapists 1) possess expertise that is generalizable to the majority of topic areas due to the “psycho-behavioural, social foundation” [OT] of occupational therapy, and 2) serve a dual-purpose as an expert on diverse users, and a situated user themselves when analysing health-related design projects.

“OTs actually serve several purposes within an ID classroom, you are experts on people and human ability, you are experts on the area of disability and how products can become part of solutions in an integrated way within that context, and then the third thing that you

are is you are just a representative kind of healthcare provider person. So, if we are designing things for contexts of healthcare, you've got the right mindset and you've been working in the right contexts that you can have an informed and valuable opinion about things that happen. And so, to a certain extent you can be both the experts on product users and the experts on yourselves as product users. And in that healthcare context, we need expertise in both areas. So, you can kind of double up.” [DES]

Subtheme 1.1: Defining the user and understanding user complexity

Identifying and defining the characteristics of the individuals that will be using a given product is a foundational stage of the design process. However, industrial faculty noted that industrial design students have difficulty imagining users with different characteristics than themselves or characterising users at the moment of design, without regard for change, which is supported by findings from Driver, Peralta, and Moultrie (2011) and Hu et al., (2021). With access to the expertise of occupational therapy, faculty reported that industrial design students developed an increased understanding of the complexity of users, such that a single user can change over time, presentation of health characteristics may vary across individuals, and designing for the average user does not capture the needs of extreme/diverse users, which is supported by DeCouvreur et al., (2012).

Subtheme 1.2: Supporting the research process & assisting in contextualizing findings

Industrial design faculty reported that research is a daunting task for industrial design students, who often experience difficulty narrowing down methods for information gathering and analysing/comparing research, which is supported by Pirinen (2016). Occupational therapy students alleviated the time and effort spent in this phase by directing industrial design students to relevant concrete evidence and/or provided experiential evidence. Additionally, occupational therapy students helped to contextualize findings—categorizing findings based on whether it is generalizable or unique to a specific user—so that the research informed meaningful products, which are all aspects of daily

clinical practice in the occupational therapy field (American Occupational Therapy Association [AOTA], 2020).

Subtheme 1.3: Supporting problem identification & design direction:

Faculty identified that a difficult transition period in the design process is learning how to identify gaps or problem areas in research and address them through actionable design ideas, evidence supported by Sanders and Stappers (2014). Here, designers must choose which idea to develop and the most effective method to address the problem. Collaborating with occupational therapy students provided industrial design students with access to novel frameworks and processes that identified how problems present in everyday life, as well as provided structure for determining effective solutions, which is supported by findings in Young, Wagenfeld, and Vander Veen Rucker (2019).

“Already I can see that students are spending much more of their time finding and engaging with real problems and finding and engaging with real people rather than just casting around trying to understand what the success metrics for dealing with or even what the success metrics are for understanding the basic tenants of the disabilities that they are working on are.” [DES]

Subtheme 1.4: Developing skills necessary for professional success

Industrial design faculty considered both student development and the ability for a product to meet users' needs as important outcomes of working through the design process. Experiencing another discipline's approaches and ways of thinking, industrial design students developed broader definitions of key skills, such as problem-solving and the ability to identify all possible users and their needs, which is supported by McDonough and Thomas (2013). These skills were developed through collaborative experiences with healthcare-focused design projects, which were made possible through interaction with occupational therapy, as will be elaborated in *Theme 2.3*. Both occupational therapy and design faculty described that designing effective healthcare solutions requires a complex understanding of the relationship between multiple users and stakeholders, as well as how to make design decisions that account for all mentioned perspectives.

Theme 2: “Benefits of a Mutual Approach:” supports design learning

The embedded model for collaboration was defined as regular and consistent participation of occupational therapy students within an industrial design curriculum over the course of two semesters. In line with the ethnographic model of inquiry, occupational therapy students learned about design by collaborating, consulting, and participating in industrial design courses and projects alongside the design students. This model was compared to other collaboration models typically implemented and delineated in interprofessional research between disciplines (Larkin et al., 2013; Reeves et al., 2016; Silver et al., 2016), whereby students collaborate on a single design project for no more than one semester. The differences noted by occupational and industrial design faculty between the embedded model and the single design project model are based on their prior experiences participating in or observing the methods mentioned above and understanding the benefits and barriers to both ways of collaborating.

Subtheme 2.1: Defining the interaction as embedded

While only in its first year of development, industrial design and occupational therapy faculty noted that describing the interaction as “embedded” provided enough structure to describe the interfacing experience between disciplines while allowing for natural assimilation, development of interprofessional awareness, and room for error or “experimental interactions or just happy accidents” [DES]. Both occupational and industrial design faculty reported other interprofessional collaboration models can be restricted by course objectives, syllabi, or scheduling limitations, barriers supported by findings in Driver, Peralta, and Moultrie (2011), Luna et al., (2015), Mollo and Avery, (2017), and Veryzer and Borja de Mozota (2005).

Subtheme 2.2: Consistent access changes attitudes

Occupational therapy and industrial design faculty reported that access to other disciplines provided interactions that improved students’ interprofessional skills. A collaboration model where students are embedded within the same curriculum provided more touchpoints for interaction-based

outcomes to develop. The accumulation of small, unplanned experiences over longer periods of time was projected to change attitudes better than models with limited opportunities for snap experiences, which is supported by McDonagh and Thomas (2013), Hu et al., (2021), and Veryzer and Borja de Mozota (2005).

Subtheme 2.3: Ability to effectively engage in increasingly complex design challenges

As mentioned throughout Theme 1, occupational therapy students provided support to increase efficiency and enhance the stage outcomes of the design process. Consistent support from occupational therapy students over two semesters allowed industrial design faculty to assign more complex projects which required increased time, resources, and expertise, as opposed to standard design projects studying color or form. Industrial design faculty noted that complex solutions became attainable within the same time frame due to the collaborative participation of occupational therapy students, which is supported by the findings in Amiri, Wagenfeld, and Reynolds, (2017) and Young, Wagenfeld, and Vander Veen Rocker (2019).

Subtheme 2.4: Embedded collaboration model aligns well with the teaching model

Industrial design faculty described the design teaching and learning process as one that involves students participating in and completing “project-based experiences” [DES]. Faculty assumed that throughout the design process, when industrial design students faced particular challenges with process stages, they would reach out for help. When provided with the necessary terminology and methodologies in the face of a challenge, the industrial design faculty believed the design student better valued and retained the learned material. Industrial design faculty stated that the embedded collaboration model aligned well because interaction and expertise are available as challenges arise instead of other collaborative methods that can hinder progress if access and learning are not aligned, which is supported by findings in Ielegems, Herssens, and Vanrie (2016), Larkin et al., (2013), Pirinen (2016), and the World Health Organization (2010).

Theme 3: Interprofessional awareness and education approaches “Help and Hinder” collaboration efforts

Interprofessional awareness and education were identified by occupational therapy and design faculty as a necessary catalyst for collaboration. Faculty reported on-going collaboration led to a well-developed understanding of the partner profession’s terminology, theories, and processes, which enabled participants to effectively play to the strengths of both disciplines, with a necessary awareness of gaps in knowledge, to produce a greater outcome, as supported by Hitch et al., (2012) and Hu et al., (2021). When bringing together two disciplines from different content areas, such as occupational therapy and industrial design, faculty described the processes of interprofessional awareness and education become increasingly important.

Subtheme 3.1: Collaboration vs teamwork vs cooperation

Bringing two disciplines together to complete a project does not automatically constitute collaboration; all faculty stressed this, defining the difference between teamwork, cooperation, and collaboration. As described by faculty, teamwork is the result of professionals who share the same methods, goals, and mindset coming together to complete a shared goal. Cooperation is the result of professionals from different fields addressing separate parts of a solution relevant to their skillset and only merging to pair the parts to complete a solution, which Dong (2010), Larkin et al., (2013), and Hu et al., (2021) confirmed serves as barriers to collaborations and limits opportunities for successful product development. Whereas the main indicators that a project is collaborative are that both parties have equal buy-in and responsibility, and there is reciprocal respect for the knowledge of the other professional so as not “to try to do somebody else’s thinking for them” [DES]. Faculty suggested that each profession is afforded the space to approach the problem using their field-specific methods, goals, and expectations while seeking a balance to ensure that similarities and differences between disciplines are effectively employed and embraced to achieve the shared goal, which is also supported by findings in Veryzer and Borja de Mozota (2005).

Subtheme 3.2: Overlap of language, processes, and theories

All faculty acknowledged efforts to share and experience another profession's terminology, theories, and processes enable a level of interprofessional awareness that allows disciplines to collaborate and support one another effectively. Faculty agreed that this type of educational experience solidifies students' own professional identities, understanding of other discipline's approaches, and the opportunities available when developing relationships between two disciplines, which is suggested by Hu et al., (2021). Faculty reported this type of collaborative model allows for a higher-order perspective on the collaboration process, such that students will not only see a completed project through the lens of their own contributions, but they will also have repeated opportunities to understand the contributions of others, with the belief that shared understanding enhances mutual respect, which supports findings in Bowman, Nygard, and Rosenberg (2014).

Subtheme 3.3: Importance of recurring awareness sharing

All faculty suggested that oftentimes, in collaboration, interprofessional awareness and education are explored at the onset of the partnership to build rapport and to establish roles and responsibilities, which is supported by Larkin et al., (2013) and Pirinen (2016). However, one faculty participant [DES] with 20 years of experience with collaboration, noted the value in revisiting interprofessional awareness to continue the translation of knowledge and process, as well as the potential to prevent conflict between participating professionals, which has also been noted in Hu et al., (2021). Faculty advised recurrent sharing at different points within a single project and across multiple projects over time would maximize benefit.

“Again [conflict arose] because we didn't explain ourselves to each other, so I keep going back to the very early days when I had [occupational therapy faculty] in the back of my class and I realize that was, when we were explaining what we did, that was probably what needs to keep happening every so often so we can keep the project fresh and keep the understandings fresh and it won't be a grinding between the instructors.” [DES]

Theme 4: Benefits and challenges to accessing: “Navigation of the Obstacle Course”

A reason for collaborating with other disciplines is the opportunity associated with access, as suggested by Tseklevs and Cooper (2017). In one sense, “access” can mean access to one’s time and expertise. In this perspective, when collaborating or consulting with designers, industrial design faculty noted that occupational therapists are providing access to their expertise with the goal of improving outcomes, which has been suggested prior by McDonagh and Thomas (2013) and more recently by Watchorn et al., (2019). Industrial design faculty also noted that “access” can be defined as access to resources, such as opportunities to interface with user groups or entry into vital environments for research that designers may not be able to access without a network.

Subtheme 4.1: Barriers to access

While benefits exist, all faculty admitted that institutional barriers exist that can impact opportunities for access. At the academic level, not specific to occupational therapy and industrial design, collaborative partnerships may fail to form due to differences in course objectives, scheduling, expectations, or educational standards. For example, [OT] faculty reported the Accreditation Council for Occupational Therapy (ACOTE) limits faculty from seeking collaborations to make room in curricula beyond essential courses. Additionally, industrial design faculty pointed out that restrictions, such as health clearances, required vaccinations, and privacy standards, limit design students from accessing vulnerable users or environments even with a point-person or referral by occupational therapy.

Subtheme 4.2: Lasting professional alliances

All faculty described that when collaboration and other disciplines’ expertise and approaches are accessible, the impact can exist longer than the extent of the collaborative experience. Faculty noted that multiple students and other faculty report maintaining contact and reference to/with collaborative partners for clinical or professional problem-solving, affecting positive skill development and project outcomes even after the conclusion of an initial

collaborative experience, all of which support suggestions made by Hu et al., (2021) to improve innovation and entrepreneurial abilities post-graduation.

Theme 5: “Minding the Gap:” Professional education and training

Collaboration between occupational therapy and industrial design occurring at the academic level was reported by all faculty to address gaps in the implementation of professional education and training, noting a positive impact on student learning for both professions, which supports evidence that has been previously reported by Boman, Nygard, & Rosenberg (2014), McDonagh and Thomas (2013) and Watchorn et al., (2019). Faculty also identified that collaboration between occupational therapy and industrial design is underreported within professional training and in the real world, and there is a need for more institutions to implement and research these types of collaborations.

Subtheme 5.1: Design training in the integration of concepts and users

Industrial design faculty described that in current design education, there is a gap in how students understand and frame users, a finding which is consistently reported in the literature (Lee, 2016; Medola et al., 2018; Wagenfeld, Reynolds, & Amiri, 2017). Specifically, students homogenize users and characterize them as static individuals falling within the average or the high-performing extreme. Additionally, industrial design faculty shared that while design programs include a project in their curriculum for unique populations or healthcare, these projects are often viewed as separate from designing for the population at large, and because of this, a gap exists in the integration of the two concepts, which Hu et al., (2021) suggests, remains an on-going concern for designers to date. As described in Subtheme 1.1, industrial design faculty reported that occupational therapy involvement served to change design students’ perspectives about users, such that users are complex, dynamic, and work in systems with other non-users and their environment. Additionally, due to occupational therapists’ expertise within and outside of healthcare, industrial design faculty reported that design students integrated previously separate concepts to consider the needs of all

user groups into their design solutions, which is supported by Youg, Wagenfeld, and Vander Veen Rocker (2019).

Subtheme 5.2: Occupational therapy training in device design & object use

Occupational therapy and industrial design faculty identified that there remains a clear gap in the professional training for how occupational therapy students are taught to create and adapt devices for clients to use in their daily life, a concern cited in Mollo and Avery (2017). Occupational therapy faculty noted that occupational therapy as a profession continues to demonstrate the lack of knowledge towards processes or material use by describing the typical use of “duct-tape and cardboard” [OT] for object creation—objects typically developed for the use of individuals to complete tasks for daily living or safety. Occupational therapy faculty also reported that access to designers and the understanding of their processes and approaches to problem-solving assist in an occupational therapy student’s ability to use objects and adapt devices for clients in a functional, stable, and sustainable manner. Finally, occupational therapy faculty identified that occupational therapists typically design objects for the use of a single client; however, collaboration with designers has the potential to educate occupational therapists in making design choices to scale these objects to meet the needs of multiple users.

“We are designers in a way, but we don't know it and we don't frame it that way, so I think that collaboration offers occupational therapy students to learn about design from a designer rather than the way that typically in OT programs we teach design as create an adaptive device that meets the needs, so we are designing something, but we know nothing about design.” [OT]

Discussion

The development of this qualitative ethnographic inquiry was formulated around available anecdotal evidence from previous interprofessional collaborations occurring at a university in the Northeastern United States and emerging trends in design and healthcare in literature with a focus on

occupational therapy's role in user-centred solutions. Findings provided additional perspective on interprofessional collaborative experiences from the faculty viewpoint between occupational therapy and industrial design, uncovering rich themes highlighting the strengths, barriers, and outcomes associated with these types of collaborations at the collegiate level. Our findings validated, through a novel faculty perspective, occupational therapy's positive impact on the design of user-centred products (Dong, 2010; Larkin et al., 2013; Murphy et al., 2020; Watchorn et al., 2019; Young, Wagenfeld, & Vander Veen Rocker, 2019). Barriers to collaboration, such as awareness of the scope of practice and access to networks (Driver, Peralta, & Moultrie, 2011; Hu et al., 2021; Wagenfeld, Reynolds, & Amiri, 2017), as well as barriers impacting the translation of user needs to products (Hu et al., 2021; Ielegems, Herssens, & Vanrie, 2016; Kim et al., 2015) was also further supported by the faculty perspective. Finally, this qualitative ethnographic inquiry helped to describe industrial design faculty participant perspectives indicating that incorporating an occupational therapy lens throughout a long-term, year-long embedded model of collaboration within an existing design program helped to address these types of barriers.

Faculty findings further support occupational therapists as well-positioned to impact user-centred design solutions in interprofessional collaborations; the findings of this qualitative ethnographic inquiry suggest that this impact occurs at multiple levels. On one level, access to occupational therapy's knowledge base, expertise, and network of users improved industrial design students' skillsets while consistently emphasizing the importance of considering the universality of all users and their needs throughout the various stages of the design process (Watchorn et al., 2019). For example, in previous research, designers were reported to experience difficulty translating the needs of users to design solutions (Dong, 2010; Ielegems, Herssens, & Vanrie, 2016; Kim et al., 2015), however, as demonstrated in *Subthemes 1.2 and 1.3*, on-going collaboration with occupational therapy appeared to address this barrier—supporting industrial design students' ability to contextualize gathered research and translate the problems into actionable design solutions. On another level, integrating occupational therapy and industrial design collaboratively in academia is seen to not only change student perspectives,

as proposed in the literature (Larkin et al., 2013; Wagenfeld, Reynolds, & Amiri, 2017; Young, Wagenfeld, & Vander Veen Rucker, 2019) but doing so also bring awareness to gaps in professional training and suggests possible solutions, as demonstrated in *Theme 5*, meaning that the embedded collaborative experience improves student problem-solving and user-analysis. Acknowledging the impact of this embedded collaboration model on student learning and industrial design outcomes at this institutional level supports the continuation of this model as it reduces barriers identified in *Subtheme 4.1*—course objectives, scheduling, educational standards, or restrictions such as health clearances.

While the findings of this qualitative ethnographic inquiry indicate that collaborations with occupational therapy reduce barriers impacting design, participatory observations throughout the collaborative experience identified that while reducing some barriers, new barriers arose. For example, previous research identified that designers experienced difficulty engaging with users who could not participate in the design process due to cognitive or verbal challenges (Boman, Nygard, & Rosenberg, 2014). Through collaboration, the OTD students addressed this barrier by serving as proxy users; however, the industrial design students appeared to have a unique difficulty translating this knowledge to design solutions. Working within embedded teaching and learning coursework model over an academic year, all faculty reported the students experienced more interprofessional awareness than other collaborative models that occurred over shorter time frames. The literature and supporting evidence in *Theme 3* on interprofessional awareness and education suggest that on-going interprofessional practices should reduce this barrier (Larkin et al., 2013; Pirinen, 2016; Hu et al., 2021). Additionally, the embedded collaboration model provided the industrial design students with consistent access and opportunities to ask for clarifications or further information, yet industrial design students had to be reminded by faculty on several occasions to take advantage of this assistance. Further research needs to be completed to identify whether there exists a threshold to the amount of access that is beneficial between disciplines and what knowledge strategies are most effective to enhance communication between both disciplines.

Limitations

This qualitative ethnographic inquiry represents the informed opinions of one private university system in the Northeastern United States. Transferability of the findings are limited to programs with similar institutional structure and opportunity for collaboration. As an emerging practise area, the number of eligible faculty participants with years of experience and comparison models was limited. The perspectives shared by the faculty participants from both professions, while informed by experience and observation, are the sole opinions of those participants. Had another sample population been accessed, themes and subthemes may have varied. Each faculty participant varied in level of experience teaching and amount of time spent collaborating with occupational therapy and industrial design. For example, two faculty participants had nine months' experience, and another, 20 years in an occupational therapy and industrial design collaboration. Similarly, the ability to compare models of collaboration is impacted by the fact that one model has been sustained for 20 years, while the embedded model, lasting one academic year, was in progress during the time of data collection.

Due to the nature of the doctoral occupational therapy curriculum and timeline under which this qualitative ethnographic inquiry was conducted, the findings are limited in the level of triangulation and time available to complete data analysis. In order to fulfil doctoral academic requirements, data collection was implemented by the OTD student during the fifth and sixth months of the nine-month (one academic year) embedded collaboration. Therefore, the findings and discussion of outcomes for the embedded model are limited by the faculty participants' experience to date.

Conclusion

Having explored the collaboration process and the outcomes associated, this qualitative ethnographic inquiry of faculty perspectives contributes to the growing knowledge supporting occupational therapy's role in interprofessional collaborations to develop user-centred universal design solutions. The qualitative ethnographic inquiry methodology used was able to capture and

uncover further significant concepts linking the impact of occupational therapy in the context of collaboration to interprofessional student learning outcomes, approaches to the design process, and addressing gaps in both the industrial design and occupational therapy professional education. While themes and subthemes suggest that any level of collaboration that incorporates interprofessional awareness and access to resources proves positive, the additional components identified in the embedded collaboration model facilitate higher-level skill development. For example, if any level of collaboration between occupational therapy and industrial design improves the learned design process, then the consistent access and flexible interaction associated with the embedded collaboration model will also improve the learned design process, even as it applies to complex design challenges.

The above findings advocate for further research into the approach, structure, and implementation of collaborative programs and processes, especially embedded models. Diverse research efforts are needed to validate the preliminary findings outlined in this qualitative ethnographic inquiry and the impact of those findings at the academic and professional level on students, professionals, and the occupational therapy and design fields.

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Appendix 1: Themes and Supporting Excerpts from Interviews

1. Collaboration Impacts the Learning of Design Process

1.1 Defining the User & User Complexity

“They are realizing that it’s not as monolithic as they would have thought. For instance, you know thinking about people on the autism spectrum, they are realizing this could take all different forms and they are understanding the challenges better of design for that there is not one solution that is going to work. Like ultimately if they wanted to do thesis they can’t say that I’ve created this product or system that is going to treat people with autism—they are going to have to be more specific about that. And, clearly by the way they are talking about this stuff, I think that they appreciate that. I also think that the collaboration has done a good job of making them understand that, these situations are all dynamic and that are not static. They are changing all the time and I think that is another dimension that OT involvement has brought to this, because the fact that you guys are you are improvisers and that you’ve made it clear that you are always dealing with, or not always, but often dealing with a changing situation as somebody either improves, or their condition changes or you know if they have a degenerative condition and its getting more difficult to deal with; I think that that the discussion about that kind of stuff has been really good for the students to understand that they can’t just design one thing that just kind of sits there that is always going to work. We have a tendency, and again this goes back to basic design training and curriculum, we have a tendency to think that we, that most of the products we design are for the user as we can conceive of them at the time we design and that that situation is never going to change.” [DES]

“So, industrial design students tend to, like most people, they reflexively assume that everyone is able-bodied and fully competent mentally all the time and they are not really sensitized to the fact that everybody has impediments or difficulties at some point in their life. So I think that the perspective that you guys bring to it is really important. And I think that it extends beyond the immediate accessibility/caregiver project, I’m hoping that this sort of on-going exposure will sensitize them in general to kind of automatically think about

the fact that they are not just designing for all of their fully cable-bodied, 20 something year old peers. I'm hoping that it changes mindsets a little bit.”

[DES]

1.2 Research Methods & Contextualizing Findings:

“There is no way that the industrial design students would be able to, they would just be overwhelmed if they tried to do online searches and random interviews. So I think that the benefit of having [occupational therapy] involved is to contextualize everything...” [DES]

“It's very different to hand someone a book or have them watch a taped TED talk on a disability because then as soon as they have questions or as soon as they have data that doesn't fit what the canned information was that they saw, they are going to start suspecting that information, and they are going to re-open the can of worms rather than having somebody that can sort of immediately explain how the corpus of content and knowledge in the field connects to the new observations that our students are making. I think that's the biggest thing here. That industrial design and especially the graduate industrial design here it's very much about field observation and data gathering, so students tend to come back with baskets of relevant and irrelevant information and they spend a lot of time just trying to set up theoretical frameworks within which to evaluate the things that they've seen and attach valid interpretations to what they've seen; having someone who can be at their side to give them frameworks for interpreting their observations rather than having them have to build that from sticks that they are finding in the forest, is moving them forward so much more quickly and so much more effectively than the previous approach which you know has, as a prime exponent of the approach, which I still characterize as kind of a blind bumbling.” [DES]

1.3 Problem Identification & Design Direction:

“Already I can see that students are spending much more of their time finding and engaging with real problems, and finding and engaging with real people rather than just casting around trying to understand what the success metrics

for dealing with or even what the success metrics are for understanding the basic tenants of the disabilities that they are working on are.” [DES]

“I think even the way that you, that OT as a profession classifies things and you know you have that taxonomy that you work with. I think that was a big eye opener for the design students. It was for me as an industrial designer because I didn't know that that existed and I think another benefit of that is for design students when they approach problems of accessibility they tend to get a little overwhelmed like they don't know where to start, and they either get stuck or they go in a direction that doesn't make sense sometimes so I think that's particularly, even thinking back on past capstone projects that I've advised students on, the undergrads, that's where projects have gone off the rail, because I've seen design students sort of go down a particular path without, based on their design intuition but not based on solid enough research or interaction with the population that they are designing for.” [DES]

1.4 Marketable Outcomes:

“What I think is that particularly with OT involvement, I feel like your perspective can be valuable for almost any design project. Just because I think you are better tuned into as a profession, than the average design student is, to how somebody physically and cognitively might interact with an environment or a product. My hope would be that this becomes kind of more integral, I think it does have the potential to give us sort of a leg up on other design schools.” [DES]

“You can take a designed product and ask OTs to critique and validate it.” [DES]

“A good designer is serving multiple constituencies. Obviously, our primary duty and interest is to serve product users, but often products have more than one set of users. And often the customer, the person who makes the buying decision on a product, is not the same as either of those sets of users. And healthcare is a really interesting model there, where that is the usual situation where the customer is not the payer, and the payer is not the first user of the product, and the first user of the product is not the patient, who is generally also the user of the product. And designing products within a healthcare

context is kind of the equivalent of New York City in the old song, where if you can make it there, you can make it anywhere. If you can understand a situation where you're dealing with insurers and hospital administrators and the people who work in the supply chain, and then the medical direct healthcare professionals that are facing the patients, and then the patients, and then their families, and the stakeholders in this process. If you can design effectively in this context—oh and I forgot all the regulatory issues, and the technology requirements around this—if you can do this, you can do anything. I often told my students that if you've got a healthcare product in your graduating portfolio, you can get a job designing water bottles, you could get a job designing sneakers on the basis of that; if you have sneaker or a water bottle in your portfolio, could you get a job designing medical products from [x healthcare company]? You probably couldn't. It doesn't go both ways. But designing in a healthcare context is an excellent way to demonstrate that you've mastered the complexities of the industrial design profession at a high level because there is so much to take into account and understand.” [DES]

2. Embedded Model Supports Design Outcomes

2.1 Defining the Interaction

“I think it's a pretty good word actually because it doesn't necessarily define what the interaction is going to be, but it defines what the location and the adjacency and the availability is going to be which I think has really been kind of a problem in the past, we've tried to define exactly what the interaction is going to be without making room for experimental interactions or just happy accidents that can happen.” [DES]

“I think that the way this played out this year where we sort of just started with the two of you kind of observing was useful and the barriers in the past have been, and I can't quite articulate how, but we have run into problems in the past, that the OT project that the juniors do where, when we've had grad students involved because there was definitely a difference in approach between industrial design students and the OT students and that led to a couple conflicts because I don't think that those two student groups understood each other very well going into the project. You know they dove

into the project, they met with the client, the industrial design student started doing what industrial design students do, and that wasn't necessarily the way OT students would approach things and that led to some conflicts in the past.” [DES]

2.2 Consistent Access Changes Attitudes

“I had gone to a design for health care conference about a year and a half ago and the recurrent issue is access to caregivers and health care professionals. In fact you can't get into the hospital often enough to really make that meaningful. So it tends to be really sporadic, you kick off a project with some health care professionals and then the students go off and do their thing and they present it at the end, but there is no on-going involvement, and I feel like that we are really well-positioned to go to gain an advantage in that respect.” [DES]

“I think that doing it over the long term is really valuable. I think that the two of you have brought a different perspective, even like some of the questions you ask occasionally are just different than what a designer would ask and I think that's been, that continues to be useful even in projects that don't involve accessibility. Those little opportunities for the two of you to provide input would be really hard, would be a lot harder to get at if this was just sort of a sporadic thing where you just kind of came in for either a given project or for like a two studios and then you were gone, and I'm inclined to think that that on-going involvement is more, is does a better job at sort of changing attitudes that sort of the one shot or one project kind of involvement brings.” [DES]

2.3 Take on Increasingly Complex Design Challenges

“Some things we might not have taken on had we not had the OT access. The fact that we're doing the circular economy and emergency medicine project, one of the reasons that we thought that was appropriate was because, again OT would be really great at helping students. Otherwise that project might have gone by too quickly for students to do the necessary research into the context of care and how the humans involved in receiving the care might have been, that would have been a heavy research to ask, and as it is, we know

that they are going to have another couple of weeks of access to you guys to validate some of that stuff, and also to a certain extent its valuable that you can be experts on humans.” [DES]

2.4 Integrates Collaboration with Teaching Model

“I think more important challenge is linked to the way that we do teaching and learning in design. Where rather than take a bunch of content and present it to the students and test them on it until they are good at it and assume that the learning is happening and the relevance of that content will eventually become clear, either intellectually or in the course of practice. What we tend to do is we set up learning as a series of project based experiences. and we wait until the students are challenged by particular difficulties in achieving the stage goals of the project at which point they will reach out to us generally for more information in the course of our studio teaching, and that point we know that the students will value methodologies and the terminology and the ways of thinking that we are going to hand them at that point because they need it then. The problem with that in terms of the interaction with other disciplines, is it doesn't always happen at the same point of a project and we like to be able to wait until the students says I need habit of mind x will you give it to me, and then we hand it over. Last night in class, we actually had this moment where a student was saying I've met and I've interviewed these 4 people with autism, who could possibly put this in context? I'm like whoa dude, you need to talk to OT at this point because they can absolutely talk to you about issues that these people have in common and where the overlaps are and whether they are off to one side or at the top or in the middle of the general run of people with conditions like this, and he's like “I'm going to go do that immediately.” That's a real success for us with a project like this because it lets actually stream another discipline and their expertise into the teaching methodology that we use.” [DES]

3. Interprofessional Awareness and Education Approaches Help and Hinder Collaboration

3.1 Collaboration vs. Teamwork vs. Cooperation

“I think the, one always makes a mistake as a professional when you try to do somebody else's thinking for them.” [DES]

“One of the big things about collaboration for it to be effective, interprofessionally, both sides have to have equal buy-in and equal responsibility and equal respect for each other's knowledge, and it has to have reciprocity too. Without those elements it's not going to work.” [OT]

“When we became [an integrated university] the prediction was that every project was going to be [health/medical-based], and I said but that would be really sad. That's not the idea, the idea is to keep the disciplines the disciplines and here are these really neat things where they can have these crosses where we can work.” [DES]

“The real test of how it all started was the fact that we started sharing vocabulary and looking for commonalities as opposed to looking at what was different about our two things. And I've seen other collaborations start around here and not go very far because it's all about the differences, it's not, ‘we do it this way and that's positive’; it's, ‘oh well we don't do it that way.’” [DES]

“Yes absolutely, absolutely. I think it's tough because it shouldn't be you're the designer you build the thing, I'm the OT I know everything about the client. It should be, you know just as much about the client as I do and I know just as much about the device and how it came to be as you do. And therefore where we do this trick where we have everybody swap the explanations where the ID person presents the client and the OT person presents the object. That sort of cements that deal. Where there were years where I said that and we got crickets because they weren't able to do that. They had each done their own parts, that's cooperating, that's not collaboration. So I don't look at the cooperating years as sort of a high point of the program, that's all.” [DES]

“Understanding the differences between those things as well as what I spoke of before, the really interesting underlying commonalities between the disciplines, those were really really interesting things to uncover and I think it’s very valuable for students to understand that just because you are collaborating with someone in another discipline this doesn’t mean that you have the same goals, and this doesn’t mean you share the same methods in getting to those goals, and it doesn’t mean that you share the same mindset in moving towards those goals, and in fact if collaboration is defined as we define it here in industrial design, that it is making an idea better by working with people who bring things to the table that you can’t; it’s actually better that they are working with different mindsets and different standards and different expectations. If you were working with someone where you do share all those things, chances are working on a team, but you wouldn’t be doing collaboration. And if we as a university have staked a lot on this idea of nexus learning, which is all about learning to work and learning to learn in a collaborative way, and we don’t know what we mean by collaboration, it’s going to be really hard to get there. And so this understanding of the deep methods of values of collaboration is one of the big things that working with OT can bring to industrial design and I’m hoping the corollary of that is also true and you are getting that from working with us.” [DES]

3.2 Overlap of Language, Processes, and Theories

“I think that the fact that we have sort of started off more slowly didn’t dive right into a project but just had a period in which we sort of got an acquainted I think that that helped break down some of the barriers a little bit and I would definitely advise going forward that we do something like that, where we either spend time with you with the OT students kind of observing or we do for you kind of what you did for us and give you sort of a primer on the design methodology and the kinds of research that we traditionally do. So just to you know a sharing exercise, so that we sort of get to understand each other better before we actually start working on projects together. But I think that’s the biggest potential barrier.” [DES]

“It meant we had to sit down for many hours and compare vocabulary and that’s really where the whole magic, we call it this, oh you call that that, we

call this this and we measure it this way oh well we don't call it that, we call lit this, and we don't measure it, we just take that and it was this whole amalgamation of thing, this patchwork quilt of completing each other's sentences but we didn't know the language of each other and we came up with the principle... that the OTs advocate for the user of the product and the designers of course advocate for what the product is able to do and if we swapped roles in the class our successes went up.” [DES]

“That's where the real transfer of knowledge and some of the methods that are used in projects came from, introducing each other's tools, like how we do 7-14-28 task tool analysis, COPM is right out there and we did just an overlay of the two, and it's just a difference of just some difference of granularity, we probe deeper in this area and you probe deeper in that area, and then over time how do you assess the clients' needs as the clients are matched up to the OTs and how do you take that pair and match it up to the design students, it didn't always work, very difficult. There were some screaming matches early on...but the essence was, we say you need to get down on the ground and work in order to understand your performance, and that is exactly what needs to happen in occupational therapy. You need to get down and work with the client to know how you impact change or affect change, bring about change, so that was again common ground.” [DES]

“So it's been a tradition since I guess the second or third time we presented and it as really just a whim because we were sharing vocabulary and it was really interesting to hear the interpretations that we got. It was important to me that the industrial design students understood how to speak about the person as the whole person, again, core OT values. The whole person, and not a disability, not a disease, not a problem, not a condition, and never even occurred to use the word patient in any way, and yet that does crop up earlier. So in thinking about it, I said well, what if always the ID person whenever they talk about the project, in class, to me, publicly, and definitely when they make the representation, they always have to describe the client. You know, how do you find this person? What are their abilities? What are their desires? What's their environment like? Again, person, environment, occupation right, how do you do that? And it's such an important part of what we do as industrial designers, but it comes across as universal design principles which I don't really

subscribe to, you can't write it down and codify it, it's a thing you feel. So that was really great because the industrial design students in explaining the client publicly before the device was explained, were taking ownership of their understanding like I built my understanding into this thing that you're about to see and here's my understanding, and so that's part of it, and then was "this thing", and I heard a lot of "this thing" and it does "this" and all "this thing", and I heard a lot of what the principles were behind it, when the OTs were talking about the device, and I said, it's a product, what do you mean this thing? It's the reacher-grabber, it's not this thing, give it a personality! And so by having and [OT professor] felt this was really true, by having the OTs present the product in particularly talking about the decisions that were made, the fact that there were choices, there were iterations, we tried it this way, and we tried it that way, what it was doing it was building and since it was a portfolio project especially, it was building the valuable part of this, which is you'll never make that device again, but the process that got it there and the decision making capability and the observational skills, those are what somebody is going to hire when they hire an OT or bring them in, and so having the OTs present the object and do it as though it were a client almost." [DES]

3.3 Importance of Recurring Awareness Sharing

"Again [conflict arose] because we didn't explain ourselves to each other, so I keep going back to the very early days when I had [occupational therapy faculty] in the back of my class and I realize that was, when we were explaining what we did, that was probably what needs to keep happening every so often so we can keep the project fresh and keep the understandings fresh and it won't be a grinding between the instructors." [DES]

4. Benefits and Challenges to Access

4.1 Barriers to Access

"I know that there are all kinds of like HIPAA restriction son doing that, and I don't know how practical that is but I think that would be really useful." [DES]

"There are gaps because nowhere in the ACOTE standards does it talk about teach OT students about design" [OT]

4.2 Network Maintenance

“I do know that there are people who become really good friends with their industrial design partners and when they see each other you see them outside, you see them both going a million miles an hour all the ideas still do together and things like that, so there is definitely lasting friendships that come out. And when our industrial design students hit their capstones they are usually knocking on the door of the old OT mentor and showing me everything or talking to their old OT partners for their perspectives and things so there are those kind of things that happen and that's what we love to see too.” [OT]

5. Collaboration Addresses Gaps in Professional Education & Training

5.1 Design Training in Integration of Concepts & Users

“Projects tend to sort of separate into two worlds: you're working on a project for the population at large and you just kind of assume that everyone can do everything that you can, and then we also have sort of every design school will have design projects that either involve design for people who are handicapped in one way or another, or disabled in one way or another, or you design for special population; but those projects tend to sort of stand by themselves. I think oftentimes what is missed, is the integration between those two worlds. And I think there is a little bit of a gap in thinking there. We talk about it a little, and it's probably written up and talked about in some of the journals, but I don't think it's embedded in most design training as much as it should be.” [DES]

5.2 Occupational Therapy Training in Device Design & Object Use

“We are designers in a way but we don't know it and we don't frame it that way, so I think that collaboration offers occupational therapy students to learn about design from a designer rather than the way that typically in OT programs we teach design as create an adaptive device that meets the needs, so we are designing something but we know nothing about design.” [OT]

“There are gaps because nowhere in the ACOTE standards does it talk about teach OT students about design. You know there is nothing blatantly that says

that, you know that I know, so I think that I will kind of repeat what I said that all OT curriculums include teaching OTs how to adapt an object, and how to create an assistive device. We learn that from day one, we adapt, we adapt, and we take something and make it easier for someone to do. So the gap is that, as I said, we are not teaching the principles of design as how you go about modifying a device, we are just modifying a device without understanding that. So I think that's a gap that this fulfills." [OT]

"They are always really afraid of what happens if it doesn't work, and then through the process they learn a lot of flexibility like they come in very type A, because that's just who tends to come into heartache, that's just who we are, like very concerned about deadlines which you need to be because documentation is a different story, but what happens if doesn't work what happens if we don't come up with something good. It's not about that, so through the process I feel like they become a little more flexible I feel like they become a little bit more willing to roll with the punches, they learn that the process is way more important than the outcome a lot of the times and they seem more willing to take risks, which I think is really important because we have to be able to go in with an idea and just see what happens and then be able to change it in the moment to make sure things end up OK, even in the field. I'll say they become OK honestly a little bit with failure, like it's OK that things didn't work and we talk about what we learned and that's a good thing." [OT]

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