Shared Intentionality in Hyflex Education: Understanding Engagement, Interaction and Inclusion through Lived Experiences of Diverse Instructors and Students

By Tamara Crasto

Submitted to OCAD University in partial fulfilment of the requirements for the degree of
Master of Design in Inclusive Design
Toronto, Ontario, Canada, 2023

Creative Commons Copyright notice

Abstract

Inclusive education usually focuses on including a diverse range of students while neglecting to focus on an equally important stakeholder: instructors with disabilities. Additionally, instructors with disabilities are rarely represented in inclusive education research. This longitudinal participatory study documents diverse instructors' lived experiences in remote and hyflex education, during, transitioning and "after" the Covid-19 pandemic.

Hyflex education provides the flexibility to choose between virtual or face-to-face experiences or remote and collated interactions. This approach grew during the transition out of the COVID-19 pandemic lockdown to harness positive affordances of different modalities to increase inclusivity and accessibility. Current practices and three models of hyflex execution are documented in this report.

Hyflex interaction comes with challenges communicating, coordinating and collaborating across environments. Codesigned interventions addressing these challenges are presented in this report. The effectiveness of coordination and collaboration can be understood through Tomesello's concept of *shared intentionality,* which is when people have joint attention and intention during interactions.

A developed model mapping shared intentionality, through (inter)action and information flow in hyflex environments, is presented. The implications of an abundance or scarcity of information and action within this model is discussed as (the coined term) *shared intentionality black holes.* Shared intentionality black holes refer to the complete inability to foster shared intentionality, thereby inhibiting effective interaction in hyflex environments.

Keywords: *inclusive education, lived experience, instructors with disabilities, students, participatory design, codesign, virtual interaction, hyflex, shared intentionality, shared intentionality blackholes, Universal Design principles*

Acknowledgments

Dr. Peter Coppin, Primary Advisor

Peter, thank you for your positive impact on my learning experiences and opportunities these past two years. You are one of the most student-focused instructors I have come across so far, tirelessly providing your time, expertise, and connections to support students' learning, research, and designs, as well as creating communities that bring together a diversity of fields and experiences. All those aspects shaped this study and I'm very grateful to have had you as a primary advisor.

Dr. Mahadeo Sukhai, Co-Advisor

Mahadeo, thank you for all your support during this study. I'm grateful for the proverbial doors you opened (and in some cases, built!) that made the execution of this research study possible. Thank you as well for the communities you introduced me to and experiences you fostered that continue to stay with me.

"I object to intellect without discipline; I object to power without constructive purpose."

-Mr. Spock, "The Squire of Gothos"

Funding

- OCAD University, Graduate Student Project and Travel Grant
- Accessibility Standards Canada, via The Canadian National Institute for the Blind; *Building an Evidence-Based Universal Design Framework for Employment Standards in Canada* (ASC Grant #017323577)
- Accessibility Standards Canada, via OntarioTech University; *A Study of Accessible and Inclusive Virtual and Blended Information and Communication Technologies (ICTs) for the Federal Public Service and Federally Regulated Industries in Post-COVID-19 Canada* (ASC Grant #102194)

Perceptual Artefacts Lab (PAL), led by Dr. Peter Coppin

To David Barter, who I've worked closely with over the past two years, developing ideas and concepts in parallel; thank you. To Erin Lee, whose previous work informed this study and who (seemingly) effortlessly keeps our "many birds" flying and all the tangents, relational; thank you.

Stephen Murgaski, Ram Puvanesasingham, and Mariana Meiji, thank you for the discussions and feedback that directed the content in this report. Zainab Hussain,

Sandra Law, Ali Raza (Syed), and Robert Ingino, thank you for your input during our meetings; it was great working alongside you all!

Personal

To my family, who have paved all the roads I travel down (this one being no exception), with their love, emotional and financial support, and humour; no thanks will ever be enough and I'm forever grateful. Stefan, the *temporal-synchrony* of our respective research projects, fostered *shared intentionality* and provided a (much-appreciated) light-hearted outlet for the joys and tribulations that come with research!

To Nakul, thank you for your encouragement to begin this journey, and for your continued support and love throughout.

To Katryn, thank you for your generosity and curiosity, your knowledge-sharing and wisdom, your friendship and support.

My friends (seasoned and new) and the Inclusive Design cohort, who all shaped and contributed to this experience in their own unique ways; thank you all.

Participants

To all the participants, thank you for sharing your lived experiences, for the time you dedicated to this study, and for your perseverance of education and learning, throughout the COVID-19 pandemic.

Dedicated to all the educators pushing for the best experiences for their students, despite personal, systemic, and situational barriers.

Here's to using my current position as a student, to push for the best for you; Inclusivity in education isn't inclusive if it doesn't extend to its teachers.

Table of Contents

Creative Commons Copyright notice 2

Abstract 3

Acknowledgments 4

Dr. Peter Coppin, Primary Advisor 4

Dr. Mahadeo Sukhai, Co-Advisor 4

Funding 4

Perceptual Artefacts Lab (PAL), led by Dr. Peter Coppin 4

Personal 5

Participants 5

Table of Contents 7

List of Tables 13

List of Figures 13

1.Introduction 16

1.1 Background and Purpose 16

1.2 Problem Statement 16

1.3 Research Question 17

1.4 Outline of Report 18

2. Literature Review on Inclusive Education 18

2.1 Summary of Themes and Identified Knowledge Gaps 20

3. Method 21

3.1 Study Design 21

3.1.1 Survey 22

3.1.2 Retrospective Narrative Inquiry (RNI) and Semi-Structured Interviews 22

4.1.3 Observation Research 22
3.1.4 Co-design Sessions 22
3.2 Ethical Considerations 23
3.2.1 Ethics Board Approval 23
3.2.2 Consent and Confidentiality 23
3.2.3 Positioning and Bias 23
3.3 Data Collection and Analysis 24
3.4 Participants 24
3.4.1 Recruitment and Screening 24
3.4.2 Final Demographics 24
3.5 Overview of Research Activities and Participants 25
4. Development of a Conceptual Model 26
4.1 Underlying Framework for Interaction and Collaboration 26
4.1.1 Behavioural setting 26
4.1.2 Virtual behavioural setting 27
4.2 Components of the Developed Model 27
4.3 Example of Shared Intentionality in Hyflex Modes 34
4.4 Significance of the Model 34
4.5 Shared Intentionality Black Holes 35
4.6 Model Limitations 36
5. Findings 38
5.1 Theme: Feedback and Responses 38
5.1.1 Situation: Digital shells 38
Student Digital Shells 38
Meeting Shells 40

5.2 Theme: Bounded Rationality and Cognitive Overload 41
5.2.1 Situation: Buck-Passing 41
“Error: Too Many Redirects” 41
Resources 43
5.2.2 Situation: Student Disengagement 43
Distractions 43
Cluttered virtual environments 44
“Constructive” Disengagement 45
5.2.3 Situation: Instructors as Simultaneous Multi-role Agents 45
5.3 Theme: Fostering Inclusive Environments 46
5.3.1 Situation: Uncontextualized Implementation of Accessibility and Accommodations 46
Instructor accommodations (built environment accessibility) 46
Student accommodations 47
5.3.2 Situation: Agency over Environments 48
Remote personal environments 48
Classrooms; an extension of the personal environment 48
Beyond Personal Environments 49
5.3.3 Situation: Personal Experiences 49
Help others by helping yourself 49
Experience with inclusivity and disability 50
Others “see”, others do; influencing agents in shared environments 50
5.3.4 Situation: Advocacy 51
5.3.5 Relatability and Building Relationships with Students 52
5.3.6 Disclosure and Perception of Disability 53

Resources being disclosure-dependant 53
Hiring procedures 53
Being “outed”/forced disclosure 54
Surveillance and recording of disability 54
Victim-blaming mindset 55
5.3.7 Resolving Issues 56
No “degrees” of reporting 56
Exhaustion with constant self-advocacy and inaccessible environments 56
6. Current Practices 58
6.1 Models of Hyflex Education 58
6.1.1 Convergent-Divergent 58
6.1.2 Hub and Spoke 59
6.1.3 In-situ Asynchronous 59
6.2 Teaching and Engagement Strategies 60
6.2.2 Modelling Engagement and “Seeding” Online Meetings 60
6.2.3 Diversifying Presentations and Methods of Engagement 61
6.2.4 Explicitly Teaching and Learning “Online” Skills/Organisation 62
6.2.5 Working with Disability Attributes 63
6.2.6 Accessible and inclusive design 64
Accessible design tools 64
Accessible content 64
Incorporating inclusive and accessible design considerations in courses 65
6.2.7 Intentional Choices with Software Technology 66
6.3 Building Support Systems 66
6.3.1: Colleagues and Teaching Assistants 66

Colleagues 66
Teaching assistants 67
6.3.2: Storing Resources 67
7. Codesigned Solutions 68
7.1 AV and Spatial Synchronicity to Increase Engagement 68
7.2 Feedback Indicators on Digital Interfaces 70
7.2.1 Indications of Technical Difficulties 70
7.2.2 Auto-Redaction 71
7.2.3 Visual Avatar 72
7.2.4 Artificial Intelligence Feedback and Prompts 72
7.3 Personalization Through Aggregation 73
7.3.1 Aggregation of Digital Tools 73
7.3.2 Creating Virtual Workspaces 74
7.4 Tangible Controls and Interfaces 75
7.4.1 Tangible “Tokens” for Different Workspaces 75
7.4.2 Tangible User Interface (TUI) for Customised Audio Control 76
7.4.3 TUIs for Collaborative Digital Documents 77
7.4.4 Modular 3D Diagram 77
7.5 “Internal” Wayfinding 78
8. Discussion 80
8.1 Findings and Shared Intentionality Black holes 82
8.2 Implications and Significance 83
8.3 Universal Design and Hyflex Experiences 84
8.4 Limitations 90
9. Conclusion 91

References 93
Appendix A: Survey 98
Appendix B: Retrospective Narrative Inquiry Guide 102
Appendix C: Interview Guide for Diverse Instructors 110
Appendix D: Codesign Guides (Codesign Festival 2023) 112
Virtual Distractions and Accessibility Challenges 112
Cross-Sensory Collaboration & Creation Tools 117
Appendix E: Recruitment Email 123
Appendix F: Workshop Descriptions 125
Appendix G: Consent Forms for Workshops and Codesign Festival 126
Informed Consent Form for Participants: Cogsci Workshop 5 126
Informed Consent Form for Participants: Codesign Festival 129
Appendix H: Consent Forms for Instructor Interviews and Codesigns 133
Narrative Inquiry / Semi-Structured Interviews 133
Co-design Sessions 136
Appendix I: Consent Forms for Student Interviews and Codesigns 141
Narrative Inquiry / Semi-Structured Interviews 141
Co-design Sessions 144

List of Tables

Table 1: Breakdown of research activities and participants 26
Table 2: Technical and layout set-ups of semester-long course 69
Table 3: Summary of findings in a causal pattern 81
Table 4: The link between UDL and cognitive networks 85
Table 5: Evidence-based suggestions informed by UDL guidelines. 87
Table 6: Evidence-based suggestions informed by UD principles. 90
Table 7: Overview of activies for virtual distractions codesign 113
Table 8: Note-taking template for codesign on virtual distractions 115
Table 9: w of activies for virtual collaboration codesign 118
Table 10: Notetaking template for virtual collaboration codesign 121

List of Figures

Figure 1: Visualisation of investigated area; diverse instructors, students, inclusivity, and engagement in hyflex education 17
Figure 2: Data visualisation of the scoping review records according to type and category. 19
Figure 3: Agents in the situated environment (Tolk and Uhrmacher, 2009). 28
Figure 4: Taxonomy of an agent (Moya and Tolk, 2007). 28
Figure 5: Understanding shared intentions (Tomasello et. al., 2005) 29
Figure 6: Adaptation of Tomasello's shared intentionality model (Lee et al., 2005) 29
Figure 7: Attention boundary surrounding internal representation. 30
Figure 8: Joint attention and/or overlap of agents' internal representation, resulting in joint action. 31
Figure 9: Introduction of shared virtual environment and separate physical environments. 32
Figure 10: Interface device hosts multiple virtual environments. 32
Figure 11: Information-action flow and shared intentionality in hyflex modes. 33
Figure 12: Example of a hyflex meeting with 2 remote and 3 collocated participants. .. 34

Figure 13: Information-action flow and shared intentionality blackholes 36
Figure 14: Tension between accountability, participation, and privacy 39
Figure 15: Computer-screen as a single portal for multiple virtual environments 44
Figure 16: Convergent-divergent model for hyflex. 58
Figure 17: Hub and spoke model for hyflex. 59
Figure 18: Asynchronous, in-situ model for hyflex. 60
Figure 19: Digital mediation of art/sculptural objects influences perception of the work. 63
Figure 20: Visualisation sketch of the classroom with two long tables. 69
Figure 21: Visualisation sketch of semi-circle classroom layout. 70
Figure 22: Codesign participants' interface icon brainstorm. 71
Figure 23: Codesign participants' auto-redaction concept. 71
Figure 24: Codesign participants' "auto-avatar" concept. 72
Figure 25: Image sections from video prototype, showing notifications and suggestions based on AI facial recognition from meeting attendees. 73
Figure 26: Addition of a "digital tools" feature to Canvas/Instructure LMS. 74
Figure 27: Customised dashboard of aggregated virtual software and widgets to create a virtual work environment. 75
Figure 28: Visualisation-sketch illustrating a physical token being placed on a pad linked to a computer. One token is attributed to a "work environment" and another to "school environment". 76
Figure 29: Codesign participant's LEGO prototype of tangible audio controls for virtual meetings. 76
Figure 30: Codesign participant's tangible interface prototype for collaborative documents. 77
Figure 31: Prism-based structure made of wooden sticks and attached by pipe cleaners. On the structure are clay modules, a netted surface on the left side and a canopy on top made of pipe cleaners. 78
Figure 32: Codesign participants' outline of a tool for "internal" wayfinding. 79
Figure 33: Template to document employee user-journeys 80

Figure 34: Mapped themes on SI blackhole model indicating the degrees of fostered SI 82
Figure 35: Key aspects of hyflex environments..... 83
Figure 36: Digital template to document retrospective narrative inquiry activity. 109

1.Introduction

1.1 Background and Purpose

Inclusive education has been shown to have positive benefits on all students (Alquraini and Gut, 2012). However, inclusivity in educational institutions rarely extends to instructors with disabilities (Ware, Singal, & Groce, 2021). In addition, studies show that most educators have either neutral or negative attitudes about inclusive education. This is a result of feeling unequipped; lacking in knowledge and competency to educate students with disabilities (De Boer, Pijl, & Minnaert, 2011).

The COVID-19 pandemic lockdown in March 2020, resulted in a long-term global shift to virtual environments. The affordances of this shift (distance, screens, primarily visual content) brought about challenges for a diversity of students. Pichette, Brumwell, and Rizk (2020), found “more students with disabilities reported experiencing challenges once courses were rapidly moved online due to COVID-19, and a number of students who may not have previously identified as having an accessibility need, have recently found themselves facing challenges and in need of support or accommodations” (Pichette et al., 2020, p.5). Further, social distancing led to educators and global workers struggling to adapt co- located interactions, to virtual work and learning environments (Ginley, 2020). However, remote education does have its benefits, such as “increased flexibility and choice, fewer physical, sensory, and for some, social barriers, anonymity navigating accommodations and services and innovative, inclusive pedagogy” (Pichette et al., 2020, p. 5). There is potential for the lived experiences of students and instructors to inform practices, recommendations, and interventions(solutions) that retain the positive affordances of remote learning while addressing and/or bettering the lacking components.

This study aimed to investigate diverse instructors’ (in terms of ability, language, culture, gender, age, or other) and students’ experiences with virtual environments, as well as methods to increase engagement and the scope of inclusivity in remote and hyflex (flexibility of choice between virtual or face-to-face (FtF) experience [Beatty, 2006]) learning environments. The study also aims to contribute to the literature on remote inclusive education, hyflex educational institutions and “instructors with disabilities”, who are currently under-represented, especially in the scope of inclusive education (Neca, P. Borges, M., Pinto, P., 2022).

1.2 Problem Statement

Prior work (Lee, E., Sukhai, M., & Coppin, P., 2022), demonstrated that the degree to which remote interactions with peers were successful/unsuccessful could be understood through the concept of *Shared Intentionality*. Shared intentionality (SI) is the ability for

two or more people to engage in collaborative, co-operative activities with joint goals and intentions (Tomasello et al., 2005).

Virtual environments range in SI, which can be more naturally afforded by co-located interactions (Lee et al., 2022)[1]. In response to the stages of the pandemic, educational stakeholders began to establish innovative practices and pedagogies for virtual learning environments (VLE) such as online toolkits for digital literacy, guided virtual homework sessions, collaboratively designing curriculum, virtual and domestic study "abroad", and developing resilient pedagogy (Thurston, Lundstrom, & González, 2021).

As we transition out of the pandemic, institutions or instructors are adopting a hyflex approach, which brings about its own set of challenges, innovations, and practices to foster shared intentionality.

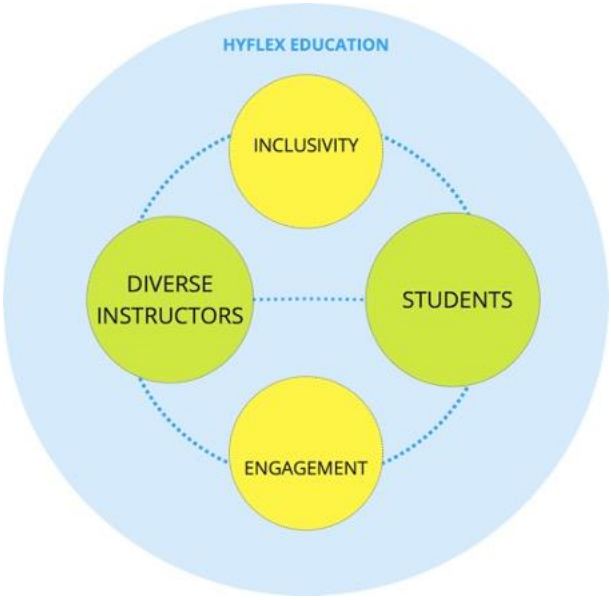


Figure 1: Visualisation of investigated area; diverse instructors, students, inclusivity, and engagement in hyflex education

1.3 Research Question

How might students' and diverse instructors' lived experiences during COVID-19 inform the development and improvement of inclusive(accessible) practices and engagement for hyflex education?

In the context of this study, the scope of education is limited to the secondary and post-secondary levels. The term engagement in this study, broadly refers to an individual's or

[1] Although this study (Lee et al., 2022) was conducted in the context of remote employees who were blind or partially sighted, the model presented in the study was applicable to computer-mediated human interaction (see figure 6) that is prominent in hyflex institutions.

group's sustained attention and shared intentionality, rather than specific types of learner engagement referenced in pedagogical literature.

1.4 Outline of Report

This report consists of nine sections, where the first three sections set-up or frame the research space. Section 1 presents the background, problem statement, and research question, which were informed by section 2, a literature review on inclusive education. The literature review also informed section 3, the study design and method.

Section 4 (the development of a conceptual model) presents a theoretical background and a model that establishes the different environments in hyflex modes, as well as the flow of information and interaction that enables joint/shared intention and joint action. Although it was informed by the content of the findings, the model is presented before the findings section, to help ground the reader's understanding.

The next three sections (sections 5, 6 and 7) present the findings uncovered during the study. These are presented as "findings", "current practices" and "codesigned solutions". Section 5 (findings) focuses on instructors' and students' experiences in remote and hyflex education. Section 6 (current practices) presents structural models of hyflex education, current accessibility/inclusivity practices and teaching/engagement strategies. Section 7 (codesign solutions) presents concepts and prototypes developed with participants, to mitigate some of the constraints experienced in hyflex interactions.

Sections 8 (the discussion), presents the findings in relation to shared intentionality, the implications of the findings in relation to the developed model, as well as the significance of the findings for the design of hyflex interactions. The discussion section also maps findings to universal design and universal design for learning guidelines, that can inform future research and design for hyflex education.

Section 9 (the conclusion) wraps up the report by reiterating the contributions of the study on the intersection of disability and remote and hyflex teaching. It also identifies the scope for future research and design for hyflex interactions.

2. Literature Review on Inclusive Education

An initial scoping review of 'Inclusive Education' was conducted across three main online databases: ACM Digital, ResearchGate, and Routledge, covering journals such as International Journal of Inclusive Education, Cognition and Instruction, Educational Psychologist, and Disability and Society.

A total of 62 records were documented, each of which were scanned and tagged with specific keywords, resulting in 70 tags. These helped establish the five categories that the records were sorted into: Education (inclusive; remote), which consisted of 30 records, Technology (assistive), which consisted of 12 records, Tangible Interfaces,

which consisted of nine records, Lived Experiences, which consisted of six records, and Multi-modal/media/sensory, which consisted of four records. Selected records covered the following stakeholders: teachers/staff, students, policy makers, instructional/assessment designers, and parents.

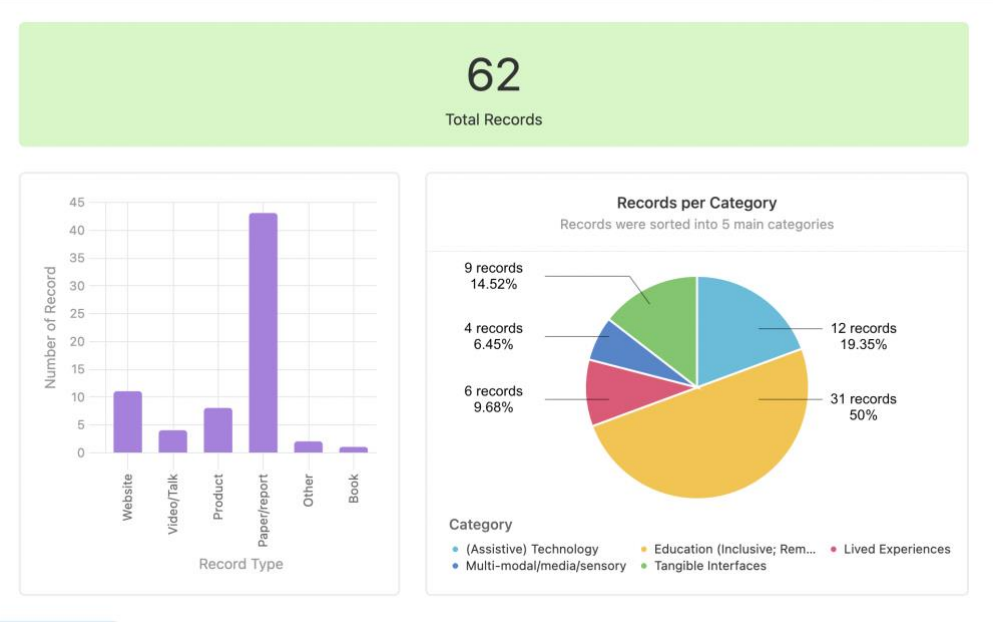


Figure 2: Data visualisation of the scoping review records according to type and category.

The general trend in the literature demonstrates that students with disabilities in inclusive learning environments benefit in terms of academic achievement, social interaction, and communication skills (Westling & Fox, 2009). In addition, other students in the same learning environment also benefit from inclusion by learning to accept and acknowledge differences, respectfully creating new friendships, receiving differentiated content, learning diverse strategies to help others communicate, and increased empathy, among other benefits (Molina Roldán et al., 2021).

As a result of the overall positive effects of inclusion on all students, there has been global recognition and action towards inclusive education. This is reflected in the explicit definition of inclusive education in laws, policies, plans and strategies in 68% of countries (UNESCO, 2020), though the degree of implementation is difficult to measure. Unfortunately, this inclusion is mostly extended to students; instructors with disabilities who are “typically marginalised within research, as well as mainstream education”, continue to be side-lined (Ware et al., 2021, p. 5) in this movement towards inclusive education.

In this movement towards inclusive education, teachers only sometimes receive adequate training specific to inclusive classrooms (Anderson, Klassen, and Georgiou, 2007). If there is some training, there is usually a gap in how it can be applied to their subject or learning environment, limited understanding about a student’s (disability) requirements, and a lack of support in terms of resources (such as time or technology) to differentiate content or individualise learning. Explicit training of teachers and

integration of the critical components[2] (Alquraini & Gut, 2012) for inclusive learning environments can result in more positive attitudes towards inclusion, which is crucial for its effectiveness (Forlin, 2013).

Developing positive attitudes towards inclusion is important, as studies show that most educators have either neutral or negative attitudes about inclusive education, because they feel unequipped, lacking in knowledge and competency to educate students with disabilities (De Boer et al., 2011).

Other practices that can benefit teaching and learning are the use of assistive technologies and multi-sensory or multi-modal approaches. Multi-sensory methods have been shown to promote more efficient learning for students in general (Shams & Seitz, 2008) and can provide differentiated educational content for special education needs (SEN) students to access knowledge and engage with (Nakalowa and Salawat, 2019), thereby increasing inclusivity. However, the scoping review showed that multi-sensory instruction does not seem to be prevalent after the primary educational years.

2.1 Summary of Themes and Identified Knowledge Gaps

To summarise, reoccurring themes in the literature regarding inclusive education were as follows:

- Inclusive education is beneficial to all students in the learning environment.
- Definitions of inclusivity in schools do not usually include teachers, culture, or language (embracing cultural and language difference are usually categorised in their own pedagogies).
- Inadequate teacher training/understanding specific to inclusive learning environments, resulting in neutral/negative attitudes towards inclusive education.
- Increased use of technology in education (especially with the growth of STEM and STEAM) without standardisation/consistency/support/training.

The scoping review also helped identify the following knowledge gaps in literature.

(1) Unequal and non-integrated representation of stakeholders.

Certain stakeholders, like instructors with disabilities, were not represented. Additionally, stakeholders were only represented in homogenous groups (only teachers, or only students with disabilities) and not in integrated or mixed groups.

[2] Accommodations and adaptations, cooperative learning, inquiry learning, universal design for learning, response prompting, embedded instruction, assistive technology, augmentative and alternative communication, alternative keyboard, touch screen, collaboration among professionals and para-educators, administrative support, professional development, role of typically developing peers, and family support.

(2) Decreased evidence of multi-sensory engagement after the primary years.

As stated earlier, multi-sensory engagement promotes more effective learning and increases inclusivity by providing different channels of access for students with different abilities.

(3) Sparse literature on the intersection of 'inclusive education' and 'hyflex education'.

While there is literature on "inclusive education" and "remote education", there is very little literature on "remote inclusive education" or "inclusive hyflex education". Prior to conducting this study, only one relevant record was found that addressed inclusive education in a remote learning environment, out of 23 search results on Google Scholar (the record was found with the search-phrase, "inclusive remote education"). However, throughout the study and after, the number of records continues to grow, as knowledge from the COVID-19 pandemic is synthesised.

3. Method

The goal of the study was to increase the scope of inclusivity and engagement in educational institutions by highlighting diverse instructors' experiences in remote/hyflex environments, documenting relevant current practices, and co-designing possible solutions or interventions to improve hyflex education.

This section will present the underlying framework and research activities that make up the study design. It will also address ethical considerations, data collection and analysis, and participant make up and demographics.

3.1 Study Design

The approach to this study was informed by the social model of disability (Oliver, 1990), which frames disability as a mismatch between a person's abilities and their environment. Within this framework, solutions aim to (re) design the environment/context, which contrasts with the medical model (Szasz, T, 1960) of disability that identifies the problem as inherent to the person and solutions aim to "fix" the person.

This was a longitudinal participatory design (Spinuzzi, 2005), that spanned different stages of the COVID-19 pandemic (see section 3.5). The research activities chosen were designed to provide qualitative data of lived experiences of diverse instructors, reflexive and inductive data of challenges faced, as well as naturalistic data of student experiences and tangible data (prototypes) as an inductive, brainstorming, and problem-solving approach.

3.1.1 Survey

A pre-workshop digital survey was sent out to all participants who registered for "Fostering shared intentionality for diverse learners through cross-sensory interaction design" (Barter, D., Crasto, T., Lee, E., Ingino, R., and Coppin, P., 2022) workshop at Cogsci 2022, 44th Annual Meeting of the Cognitive Science Society. The survey was used to tailor the workshop research activities to participants' accessibility requirements.

Additionally, the survey was also used to inform the retrospective narrative inquiry (see next-section, 4.1.2) activity by identifying participants' experiences of working/learning during the pandemic. To achieve this, participants were asked to reference six story arc models, pick one or a combination of models that best reflected their experience, and outline it (Appendix A).

3.1.2 Retrospective Narrative Inquiry (RNI) and Semi-Structured Interviews

This research activity was designed around the three dimensions of narrative inquiry (Clandinin & Connelly, 2000): interaction (personal and social), continuity (past, present, and future) and situation (place). It was a reflective exercise meant to narratively describe participants' experiences with virtual learning and working environments before the COVID-19 pandemic, during lockdown, and transitioning out of lockdown (Appendix B).

This activity, conducted in a hyflex model (section 6.1.1), helped produce insights into the challenges and benefits participants experienced during this time. The three dimensions of narrative inquiry also guided the semi-structured interviews (Appendix C) conducted with diverse instructors.

4.1.3 Observation Research

Observational research of one undergraduate course was conducted for the duration of a semester (four months). The course was conducted in a hyflex manner and provided a longitudinal opportunity to co-design classroom set-ups (physio-spatial layout and audio-visual technology) for hyflex learning.

3.1.4 Co-design Sessions

Codesign was utilised as an inductive method, as well as a way to brainstorm and generate solutions (Hagen et al., 2012). Therefore, codesign sessions were conducted at multiple points during this study, with various stakeholders (students, instructors, remote workers with accessibility needs).

Seven codesign sessions were conducted (see section 3.5), five of which were set up with a facilitated discussion or "framing" activity for participants to share their context and experiences, which helped them brainstorm or prototype collaboratively (Appendix

D). The two codesign sessions that did not follow this structure was a 1:1 session with an instructor who was previously interviewed and the longitudinal codesign within the undergraduate design course (since the context and experience of the course was shared).

3.2 Ethical Considerations

3.2.1 Ethics Board Approval

All data included was obtained from studies approved by OCAD University's Research Ethics Board. These studies include "*Features of virtual learning environments that increase shared intentionality for diverse learners and educators*" (REB #: 2022-74) and "*A Study of Accessible and Inclusive Virtual and Blended Information and Communication Technologies (ICTs) for the Federal Public Service and Federally Regulated Industries in post-COVID-19 Canada*" (REB #: 102232).

3.2.2 Consent and Confidentiality

All participants gave voluntary informed consent. Information related to the study was documented on consent forms that were provided prior to the research activity as well as at the start of the research activity. Activities were only initiated if, and when, consent forms were signed by participants. Additionally, consent information was re-iterated verbally before each research activity with the opportunity for questions or to revoke consent. Participants were also informed that they welcome to withdraw (themselves and their data) from the study at any time, up until 15th April 2023 (submission of report).

Participant data was anonymized to protect privacy, and participants who are directly represented in the report, such as through quotes, were given the opportunity to review, provide feedback, and/or redact their information from preliminary and final drafts. This was to ensure that no identifying information was included that could potentially put them at risk, and that their experiences were accurately depicted in the presented narrative.

3.2.3 Positioning and Bias

As an ex-teacher at an inclusive school, I was initially concerned about bringing in unconscious bias. However, as Paul Galdas wrote, “Those carrying out qualitative research are an integral part of the process and final product, and separation from this is neither possible nor desirable” (Galdas, 2017, para. 5). I do believe that my positioning as a current student and ex-teacher helped build a rapport with participants, as well as provide a balanced position (reflecting both roles) to enter the research and co-design space.

3.3 Data Collection and Analysis

Data for this report was collected through the research activities outlined in section 3.1, and was documented for analysis through pictures, audio and video recordings, transcripts, and observational notes. In addition, codesign artefacts such as virtual whiteboards, post-its, and tangible prototypes were also analysed. The analysis of the data followed a qualitative, inductive approach, using open thematic coding to identify and categorise emerging themes from the data.

Data was analysed using NVIVO and Dedoose (qualitative analysis tools). Transcripts were coded in sets of three, the first set establishing “bucket-categories”, the second and third sets establishing more granular categories and themes. Previous sets were revisited when new codes emerged, so that each transcript was coded at least twice.

3.4 Participants

3.4.1 Recruitment and Screening

Participants were recruited via email (see appendix E) and workshop descriptions (see appendix F) through the following professional and personal networks: research collaborators, such as CNIB, Ontario Tech University and the Canadian Council of the Blind; conferences such as Cogsci 2022; two undergraduate classes at a Canadian university; and graduate students from two Canadian universities.

Participation was voluntary and participants were screened as follows:

- Experience as a current or recent secondary/post-secondary instructor and/or student.
- Experience with either education or inclusive education.
- Experience learning/working in a remote or hyflex capacity.
- Experience with accessibility in any capacity (e.g., parent, non-teaching staff, etc.).
- Identifies as or diagnosed as persons with a disability or neuro-divergent.
- Identifies as neuro-typical.

3.4.2 Final Demographics

A total of 57 participants were included in this study. Among them, 21 participants were undergraduate students, who were observed for the duration of one course. Another 14 participants were in mixed groups of students and instructors who took part in a RNI and codesign session at the Cognitive Science Conference 2022 (in Toronto). Additionally, separate codesign sessions were conducted with four graduate students, one instructor, seven blind and partially sighted individuals (BPSI), and two deaf-blind

individuals who were working or socialising in remote/hyflex environments. BPSI were included to address accessibility in virtual meetings that are usually very visually biased.

While all participants fit the screening criteria, demographic information was only collected from interviewed participants, comprising of five instructors, two teaching assistants, one co-instructor and one student. For an overview of activities and participant breakdown, please refer to section 4.5.

The interviewed participants represented diverse characteristics, including early-onset Parkinson's disease, Psoriatic arthritis, and Nystagmus. Interviewees also identified (or were diagnosed) as neurodiverse. While specific labels of the type of neurodiversity may not be very indicative (as there is constant change and overlap in diagnostic criteria), at the time of writing this report, interviewees identified as being on the autistic spectrum, having ADHD (Attention-Deficit/Hyperactivity Disorder), and Complex PTSD (Post-Traumatic Stress Disorder).

Interviewed participants utilised assistive devices such as screen-readers, magnifiers, wheelchairs, walkers, and canes. Cultural identities varied among these participants, and included Mormon, Jewish, Romanian, American, and Canadian. Other diverse characteristics included English as a second language, being a first-generation educational degree holder, and having experiences with the foster system/homelessness. The range of diverse characteristics of participants aimed to ensure an inclusive representation.

3.5 Overview of Research Activities and Participants

Stage of Pandemic	**Activity**	**Participants**	**Total Participants**
During	Codesign A	2	4 Graduate Students
	Codesign B	2	
During/ transitioning	Survey (Cogsci-2022)	11	14 (Mixed; graduate/ PhD students and instructors)
	Retrospective Narrative Inquiry (Cogsci-2022)	14	
	Codesign C (Cogsci-2022)	12	
Transitioning	Observation + codesign D (Undergraduate course)	21 students, 1 instructor, 1 TA	21 observed students, 1 interviewed student, 5 instructors, 1 co-instructor, 2 teaching assistants
Transitioning	RNI/Semi-structured interviews	5 instructors, 1 co-instructor, 1 TA,	

		1 student	
“After”	Codesign E	1 instructor	1 instructor
“After”	Codesign F (Codesign Festival by CNIB, OntarioTech University, OCAD University)	6	9 BPSI/Deaf-Blind individuals (who work or socialise in remote/hyflex environments)
		8 (5 overlap from session 1)	

Table 1: Breakdown of research activities and participants

4. Development of a Conceptual Model

In order to frame the findings from this study and understand crucial components of hyflex environments, a conceptual model mapping (inter)action and information flow was developed.

4.1 Underlying Framework for Interaction and Collaboration

Given the collaborative aspects of working and learning in an educational setting, literature from ecological psychology, cognitive science and computer science were also reviewed to inform comprehension of findings related to human interaction, the cognitive process of collaboration as well as the role of environments on behaviour.

4.1.1 Behavioural setting

This section describes the concepts and theoretical frameworks underlying this study; behavioural setting theory (Barker, 1968), theory of affordances (Gibson, 1979), and shared intentionality (Tomasello et al., 2005). The relationship between these theories is best described by Heft et al., who state that, “‘Behavioural settings’ are generated by joint actions of individuals in conjunction with the milieu features (or affordances) that are available” (Heft, H., Hoch, J., Edmunds, T., & Weeks, J., 2014, Abstract).

Barker’s and Gibson’s ecological approaches explain that the environment (objects, arrangement of space, etc.) influences individuals’ behaviour, and perceptual cues of what is afforded by objects in an environment, can be “acted upon”. For example, in a traditional classroom, the tables, blackboard, chairs indicate the affordance of sitting, writing, and so on, while the layout of these objects could influence students to sit together, or apart, or talk together.

Behaviour setting was furthered by many other psychologists, notably Wicker (1987), who shifted the understanding of behaviour settings to being social constructions that were generated through the interactive behaviour of participants and their internal sense-making. Supplementing this, Heft et. al (2014) propose that the joint actions making-up behaviour settings also have perceptual meaning and consequently specify/inform the behaviour setting (the way the environment is set up, guides how people interact, and people interacting in the environment, reveals the way the environment works).

Joint action is the outcome or interplay of shared Intentionality (Heesen, R., Genty, E., Rossano, F. et al., 2017), which is the ability for two or more people to collaborate and cooperate (Tomasello et al., 2005). This means that behaviour setting (i.e. social constructions of behavioural patterns) can foster shared intentionality, resulting in joint action, furthering the behaviour setting, creating a self-sustaining feedback loop that informs the environment and interaction in it.

4.1.2 Virtual behavioural setting

The concepts of behaviour setting translate well to provide a theoretical framework to understand the dynamics of digitally mediated remote work and interaction. Blanchard (2004) outlines elements of virtual behavioural setting, by examining virtual social communities and computer-mediated-communication (Blanchard, A., 2004). Blanchard states that virtual behaviour settings can be examined by “the emergence and maintenance of setting programs (prescribed sequence of interactions [Wicker, 1979]), their participants, and their operation within physical behaviour settings” (Blanchard, A., 2004, Abstract). This acknowledges that virtual behaviour settings, to an extent, must take place in a physical setting (for example, attending a virtual meeting via a laptop in your home).

There are two other key points defining virtual behavioural setting that Blanchard identifies: (1) “objects” of communication, that can socially construct the virtual behaviour setting through perception and negotiation (Weick, 1979) and (2) the weakening or decoupling of time and space boundaries (Garton & Wellman, 1996). Both of these key points are important considerations in hyflex interactions. “Objects” of communications, such as emails, messages and video recordings are an integral aspect of hyflex interaction, and the implications of acting on these “objects” (by sharing, manipulating and storing them) effects agents’ behaviours in these environments. Additionally, the decoupling of spatial-temporal boundaries from shared experiences, such as in asynchronous and remote interactions, impacts how agents structure and interact within these shared experiences.

4.2 Components of the Developed Model

Based on the theoretical framework discussed in section 2.2, a conceptual model is presented, illustrating key aspects of hyflex interaction to help explain the major findings in this study.

I am adapting Tolk's and Uhrmacher's (2009) diagram of agents in the situated environment (Figure 3), and Moya and Tolk's (2007) taxonomic structure of an agent (Figure 4), from the field of computer science. In the context of this report's conceptual model, *Information-action Flow and Shared Intentionality in Hyflex Modes* (Figure 11), an "agent" refers to an individual or set of individuals (e.g., a department), who is part of the working/learning environment (rather than a software agent. These adaptations will be layered with elements from Tomesello et al. 's (2005) model of *Understanding Shared Intentionality* (Figure 5) from the field of Cognitive Science, and Lee et. al.'s (2022) adapted model of shared intentionality for remote interaction (Figure 6).

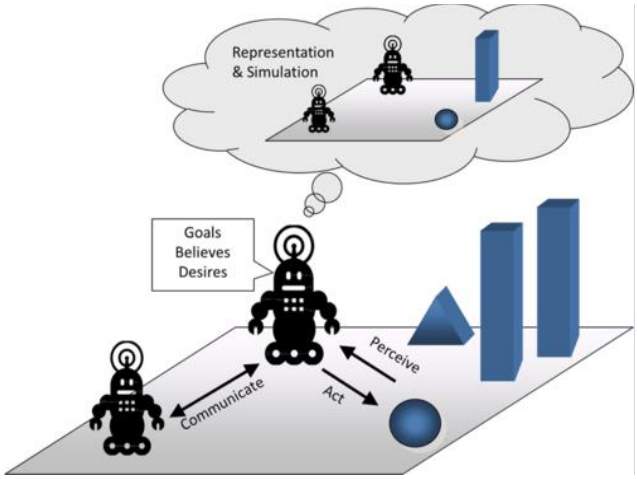


Figure 3: Agents in the situated environment (Tolk and Uhrmacher, 2009).

Figure 3 (Tolk and Uhrmacher, 2009) shows two agents and four objects, in a shared situated environment. Each agent may communicate with each other, as well as perceive and act on objects and agents in the situated environment. Each agent has goals, beliefs and desires, as well as an internal representation and simulation of the situated environment (which may differ from the actual environment).

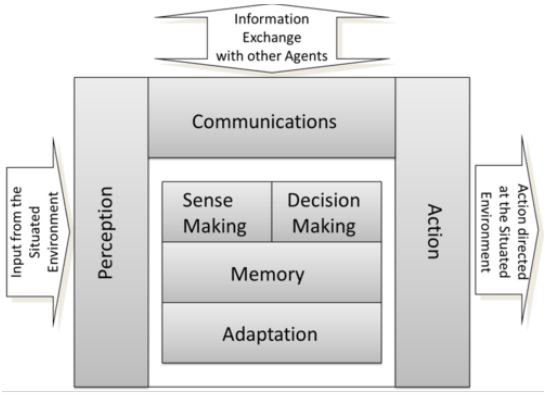


Figure 4: Taxonomy of an agent (Moya and Tolk, 2007).

Figure 4 (Moya and Tolk, 2007), indicates the external and internal domains of an agent that facilitates interaction (with objects and other agents) in a situated environment. The external domains are perception (sensory input), action (output), and communication

(input and output, or information exchange), which are also represented in the previous figure 3. The internal domains of an agent consist of sense-making, decision making, memory and adaptation (ability to update memory to reflect current goals).

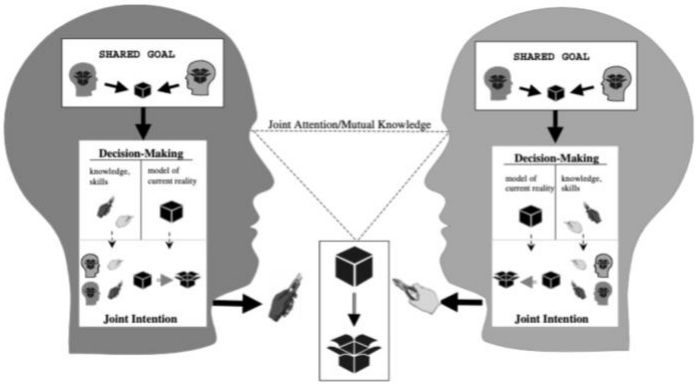


Figure 5: Understanding shared intentions (Tomasello et. al., 2005)

Tomasello et. al's (2005) model of understanding and sharing intentions (Figure 5) also shares common elements with the agent-models; goals, action and decision making (**memory** of knowledge and skills, a **representation** or model of the current reality, and a **simulation** of the future action). The model shows two people connected externally by joint attention or mutual knowledge of cutting open a box. Internally, each person has a shared goal that informs their decision making and simulation of the joint action to achieve the shared goal. This simulation is joint or shared intentionality. The model indicates that this internal state informs each person's actions to collaboratively cut open the box. The joint attention and shared goal results in joint intention.

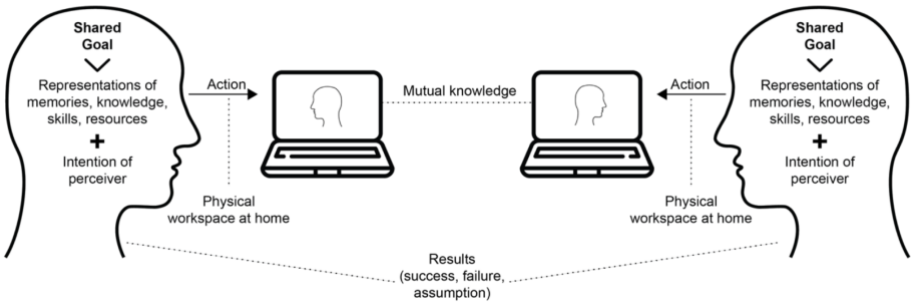


Figure 6: Adaptation of Tomasello's shared intentionality model (Lee et al., 2005)

Lee et al.'s (2005) adaptation (Figure 6) of Tomasello's model, adds the dimension of computer-mediated, distanced interaction. Each person's action is directed at the computer, in their own remote, physical spaces. Joint attention or mutual knowledge is also computer mediated.

The model *Information-action Flow and Shared Intentionality in Hyflex Modes* (Figure 11), brings together four main adaptations, outlined below, with images.

(1) Addition of an “attention boundary” around an agent’s internal representation (Figure 7), highlighting that perceptual cues and information may not make it to one’s internal representation if it doesn’t successfully permeate the attention boundary.

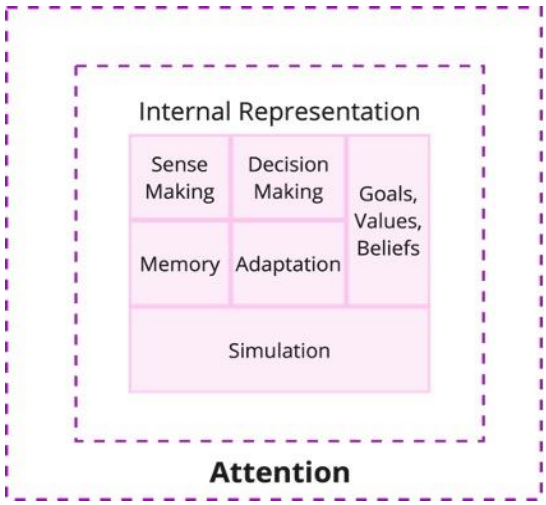


Figure 7: Attention boundary surrounding internal representation.

(2) An indication that shared or joint intentionality (indicated by the diamond on the diagram) is fostered by joint attention and/or overlap in two agents’ internal representations, and (ideally) results in joint action (Figure 8).

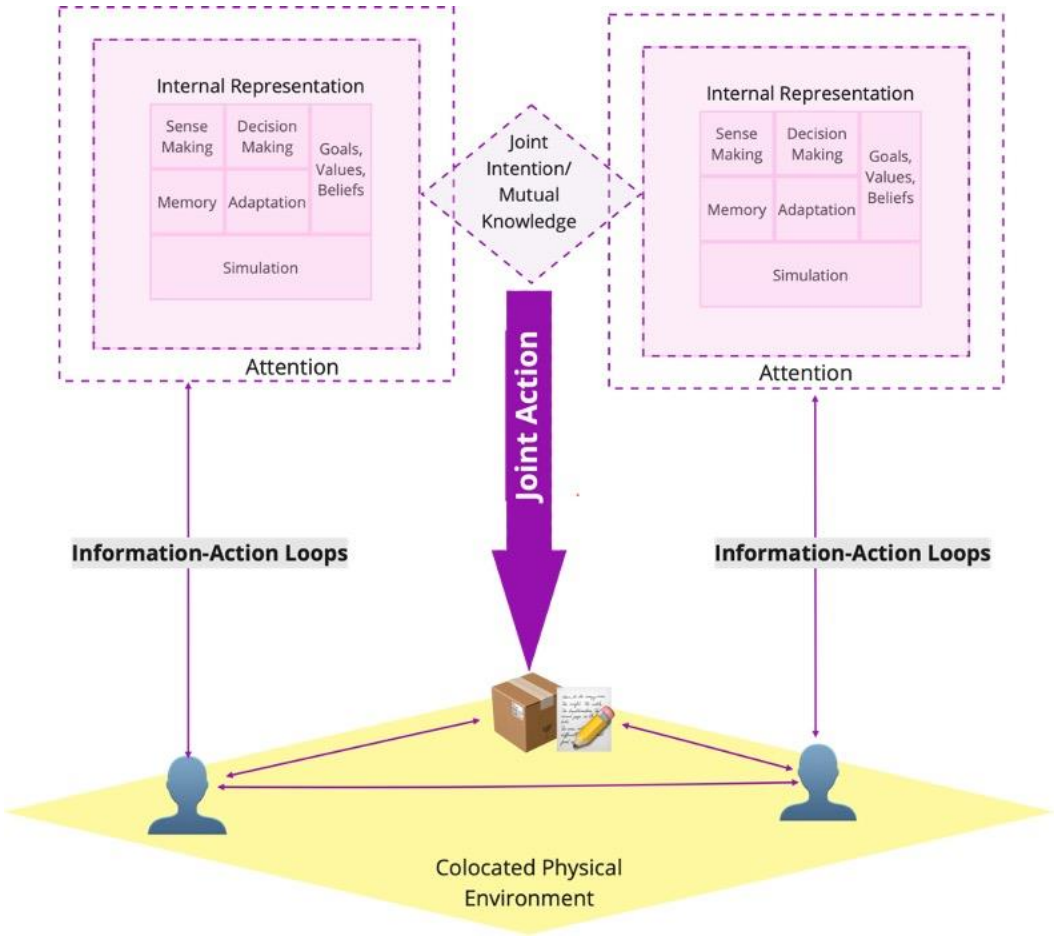


Figure 8: Joint attention and/or overlap of agents' internal representation, resulting in joint action.

(3) An indication of a shared virtual environment (Figure 9), to highlight that it has its own behavioural settings.

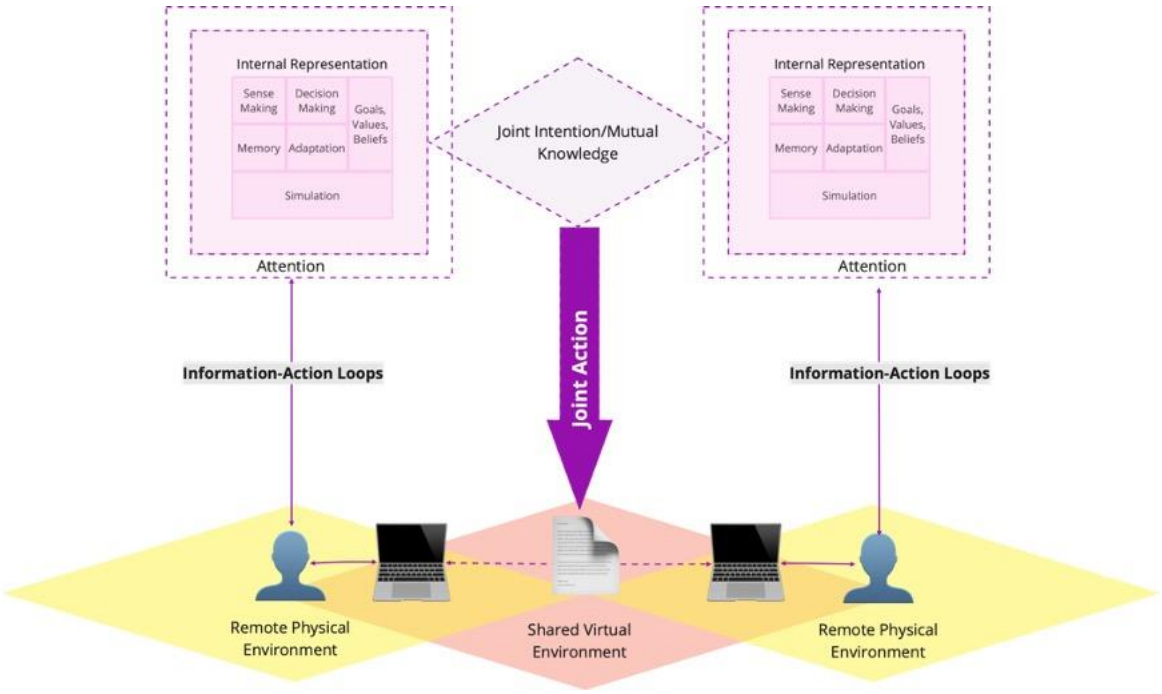


Figure 9: Introduction of shared virtual environment and separate physical environments.

(4) That an interface device (computer) can host multiple virtual environments (Figure 10).

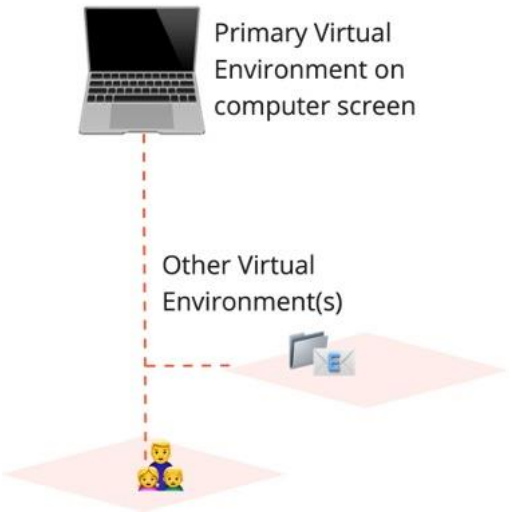


Figure 10: Interface device hosts multiple virtual environments.

These four adaptations resulted in the following conceptual model (Figure 11) that maps the flow of information (perception, action, and communication), to understand joint/shared intentionality (and therefore joint action) in hyflex interactions.

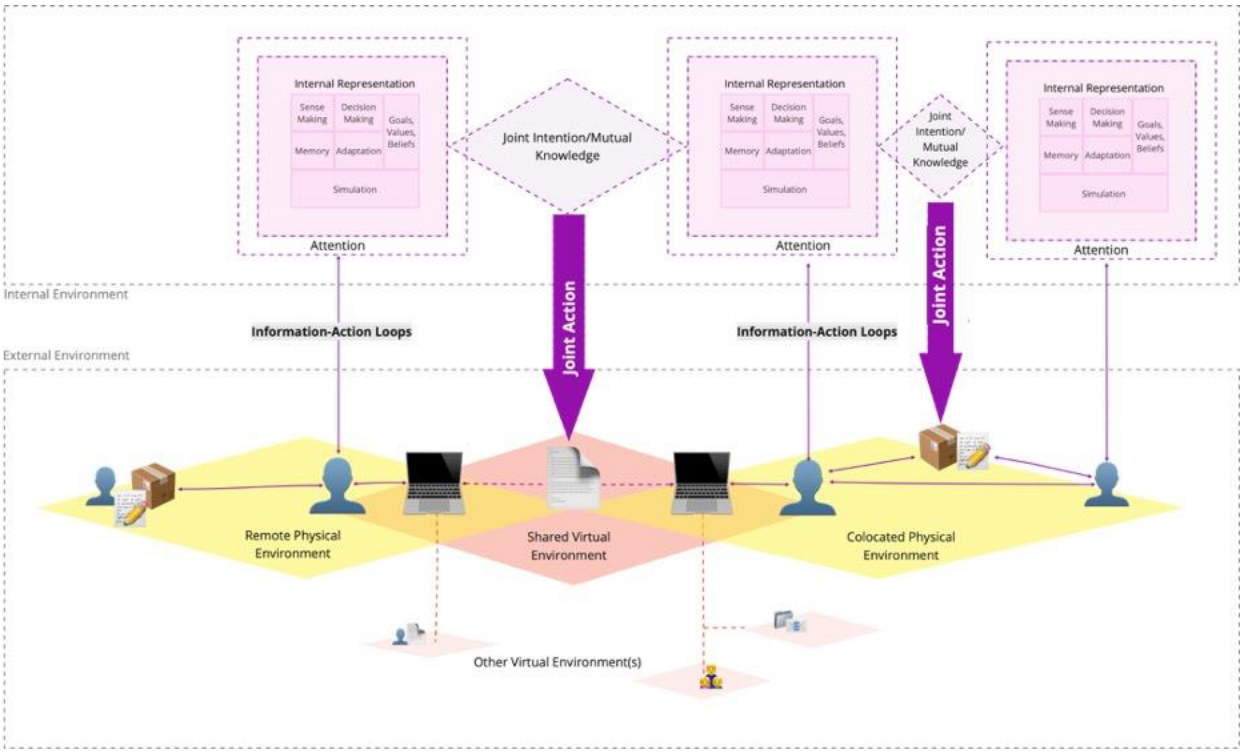


Figure 11: Information-action flow and shared intentionality in hyflex modes.

Agents in this model (Figure 11) receive information and/or act, either directly in their physical environment, or indirectly (computer mediated) in their virtual environment. This is represented by the information-action loops linking objects, agents, and their internal representation.

Joint action, indicated by the large purple arrows can also take place in either the shared virtual or physical environment, depending on the joint intention or mutual knowledge created between two agents (through joint attention and/or overlapping internal representations). For joint action to take place in a virtual environment, it is important to note differences between virtual “objects” (Blanchard, 2004) and shared perceptual information. For example, sharing one’s screen on a video call, is sharing perceptual information, while sharing a collaborative document (e.g., whiteboard or Google Docs), is an example of a virtual “object” as it can be acted upon by other agents.

4.3 Example of Shared Intentionality in Hyflex Modes

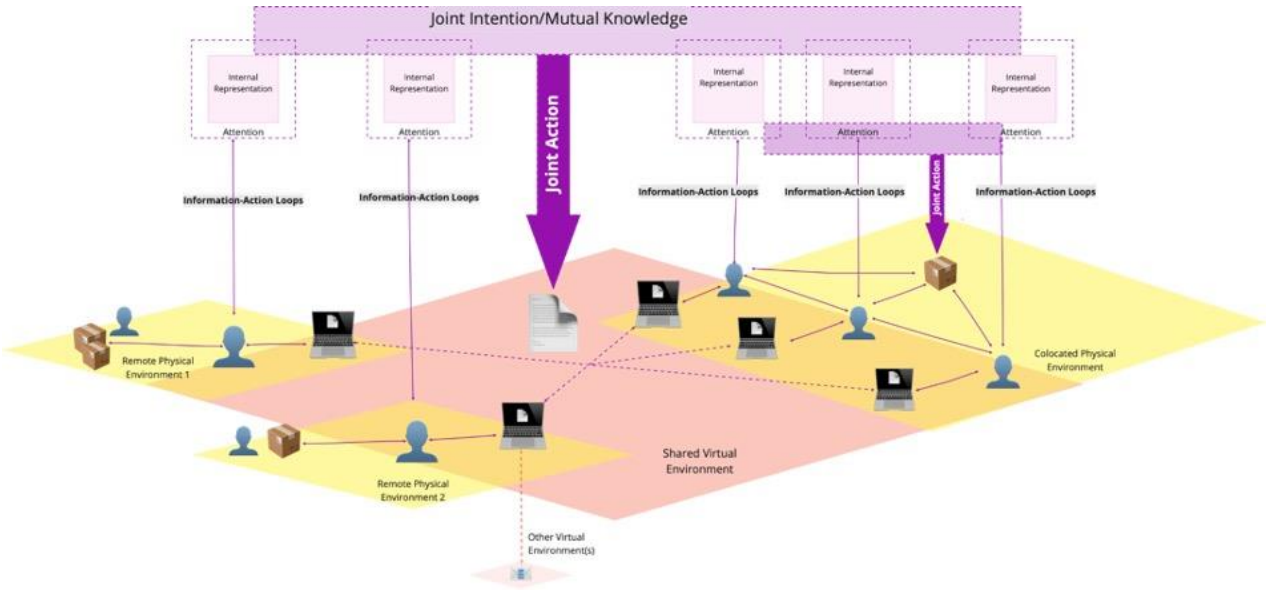


Figure 12: Example of a hyflex meeting with 2 remote and 3 collocated participants.

In this example, the model reflects a recent hyflex meeting experience, with two remote participants (defined as remote due to not being in the institutional collocated space; to the remote participant, collocated participants could be considered “remote”) and three collocated participants (Figure 12). All participants were connected to the shared virtual environment (Microsoft Teams Video Call Interface) and collaboratively editing a shared virtual document. The participants took turns screen-sharing to create joint attention, conveying perceptual visual cues when audio-verbal cues did not suffice. Otherwise, joint intention and joint action was focused on the virtual object (shared collaborative document).

At one point, one participant in a remote physical environment noted they were getting distracted by people walking past them in their physical environment, while another participant received and replied to an email from a differing (secondary) virtual environment.

Although for the most part, joint intention and action was focused on the object in the shared virtual environment, the collocated participants were able to create shared intentionality amongst themselves, with information-action in their shared physical environment, such as passing objects to each other across the table.

4.4 Significance of the Model

In contrast to previous models that indicate only one situated environment, agents in hyflex learning or working environments have a shared virtual environment as well as collocated or remote physical environments. This creates intermittently competing

situated environments. This adaptation is reflective of Blanchard's 'Virtual Behavior Settings' (2004).

As a result of multiple situated environments, each agent has perceptual information and internal representations of their own situated environments, **as well as other agents' environments**.

Two agents may not have the same informational input from the situated environment because their situated **environments differ** (as stated above), information is unable to permeate the "**attention**" boundary to form an internal representation or they have access to different **sensory input.** For example, a blind or partially sighted individual will not perceive objects in the environment in the same manner as a sighted individual, and therefore have a differing internal representation of the environment.

The mismatch of information input is furthered by interfacing devices (Lee et. al., 2022) that may also contain multiple other virtual environments that are work-related or personal to the agent, but not necessarily available to other agents in the shared virtual environment.

4.5 Shared Intentionality Black Holes

The *Information-action flow and Shared Intentionality in Hyflex Modes* model (Figure 11) is key to understanding the main phenomena observed in this study across contexts, participants and roles; the loss or reduction of shared intentionality.

This loss or reduction of shared intentionality happens when there is too much, or not enough information-action flowing through the feedback loops within agents and environments. When the expended cognitive energy maintaining the feedback loop becomes unavailable, any attempt at shared intentionality collapses, creating a *Shared Intentionality Black Hole* (SI blackhole). The phenomena takes place internally within individual agents and/or between agents.

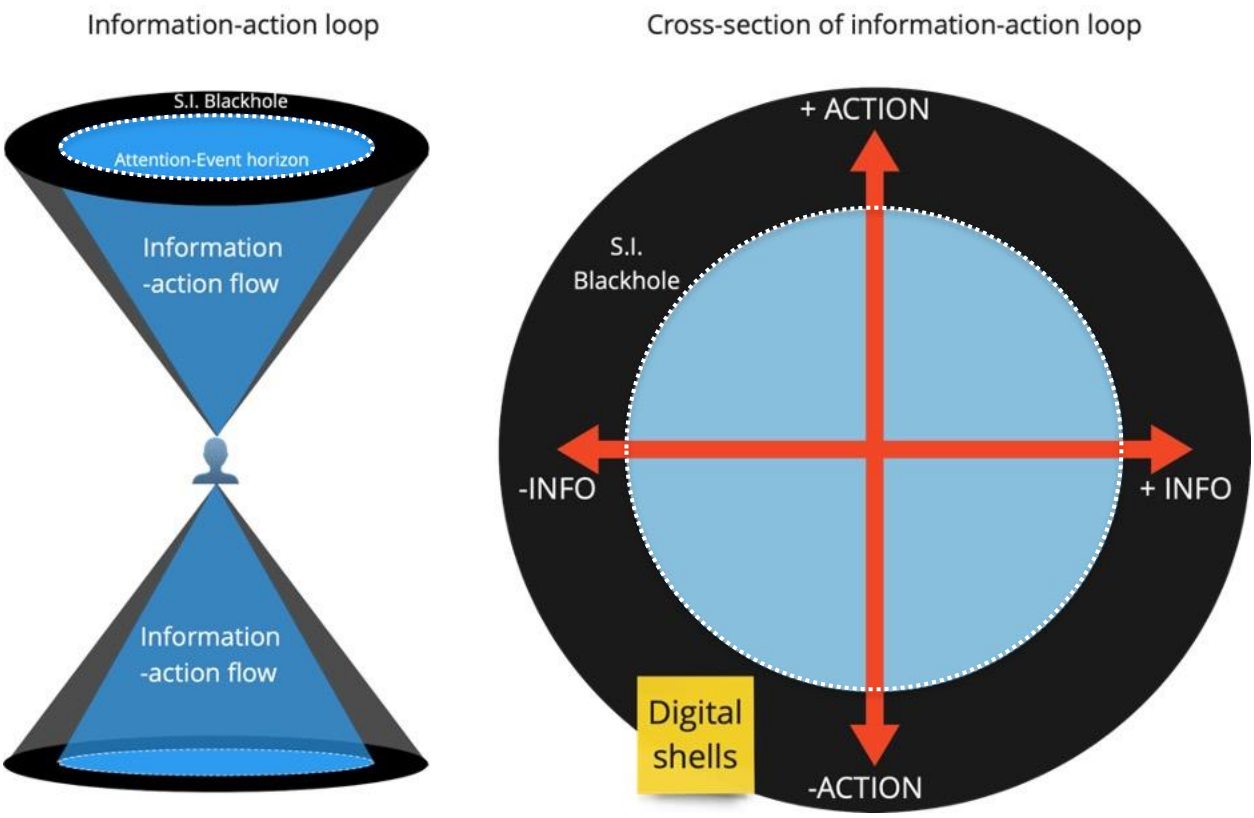


Figure 13: Information-action flow and shared intentionality blackholes

The images above (Figure 13), are more detailed representations of the information-action loops presented in Figure 11. Here, the attention boundary is presented as the attention-event horizon (to compare to the "event horizon" in blackholes, that indicate the boundary through which no perceptual information can pass or the point of no return).

An example of a SI blackhole, would be the case of "digital shells" (section 5.1.1). This is when students log-in to an online class meeting with their cameras and microphones off, and do not engage, participate, or respond, demonstrating no action (on the student's part) and very little information (for other agents). There is no possible way for agents to build shared intentionality in this scenario.

Within the blackhole metaphor, the pull of the student's attention towards other intentions, information, or environments, is akin to the gravitational force of a blackhole on an object. However, events can avoid becoming SI blackholes if information-action is provided (for example the student unmutes and responds or types in the meeting chat).

4.6 Model Limitations

While the current conceptual model (Figure 11) accounts for the different *spaces* or environments (physical, virtual, shared, and personal) that constitute hyflex interaction, it does not account for *temporal* difference (time), that the asynchronous components of

hyflex work/learning affords. Space and time are important aspects for a person's learning trajectory, which can be thought of as "movement through multiple space-time frameworks" (Chavez, 2020, p. 3).

There is potential for the blackhole metaphor to encompass the asynchronous component of hyflex/remote work or learning, through multiple "parallel universes" since events are not bound by the same spatio-temporal (space-time) experience.

For example, a class is conducted with half its students attending face to face (FtF). The class is recorded and shared with the rest of the cohort, who all review the recordings on different days at different times, at different levels of mutual knowledge creation (Tomasello et al., 2005; Lee et al., 2022), depending, for example, if they have read the discussion board before reviewing the recording, or talked to a classmate before watching the recording. In this example, the same "event" has unfurled in multiple parallel universes, with multiple different effects. As working/learning is contextual and relational (Chavez, 2020) this could significantly impact fostering shared intentionality in remote work/school.

Still working within the blackhole metaphor, "alternate universes" could be adapted to the many virtual environments that an interfacing device provides access to. The interfacing device (computer) could induce the conditions for a "wormhole", to another shared intentionality "universe".

While "black holes" would be the complete loss of perceptual information and attention, "white holes" would be the output of information, with no option for the interjection of perceptual information, communication or attention (for example, institution-wide messaging, emailed from noreply@institution.com).

5. Findings

5.1 Theme: Feedback and Responses

A common occurrence in hyflex modes, is the flooding of all communication channels (re-posting announcements across platforms), usually to cover all bases due to the lack of feedback as to whether they've been read or not.

> "*The whole semester, every announcement I posted* [on the LMS]*, I reposted that to Teams. Like what a waste of my time doing both of these platforms every single time to get 0 responses from students"- Co instructor 1*

5.1.1 Situation: Digital shells

There were two types of "digital shells" uncovered in the findings. The first was significant and repeatedly observed: instructors across the globe have been finding the lack of engagement and responsiveness on the part of undergraduate students during online and hybrid meetings to be extremely challenging (Pichette et. al., 2020; Thurston, Lundstrom and González, 2021, p. 15; Hollister, Nair, Hill-Lindsay and Chukoskie L, 2022). The second is a case of optics as opposed to experience, in which mandatory teacher training sessions were arranged, but were never conducted.

<u>Student Digital Shells</u>

Current virtual meeting interfaces allow users some control over the types of information through which other users may perceive them, such as their audio, video, or profile picture. While this is generally beneficial for individuals' privacy protection and agency, particularly for instances of meetings being recorded (six students in our study have explicitly noted a tension between privacy concerns and sharing their video and audio; this is reinforced by other research studies such as [Khan, Kambris and Alfalahi, 2022]). The absence of any perceptual data made available to others fosters **decreased accountability** on the student's part.

Figure 14: Tension between accountability, participation, and privacy

Interviews with instructors, and the students themselves in some cases, found that students displayed low or no participation in classroom activities and discussions conducted in online and hybrid formats. Their behaviour tended to avert responding to direct questions from the instructor and responding or engaging with the instructor or their peers in break-out rooms.

> *"And even then I had the experience where you would just be put into like breakout rooms and you know, you try to talk, but nobody would answer like at all. Like it was just dead silent." -Student 1*

With the student's video and audio off, the (perceptual) information and internal representation loop between them and other agents is broken, while the lack of responses in the chat or verbal responses indicates a break in the (communication) action loop. The remaining presence is merely a digital "shell" of the student, represented on the interface by their name, icon (either an image or letters abbreviating their names) and frame (placeholder rectangle for video).

Other agents in the shared virtual environment are unable to create an internal representation of this passive, unresponsive individual and are unable to communicate with them to fill in the missing perceptual information. There is no way to elicit any information from the other agent (unless they change from passive to active), as all potential feedback loops are broken, creating a **shared intentionality blackhole**.

For peer-to-peer interaction, it is thus impossible to have joint attention or intentions. For instructors or presenters, this incurs difficulties in gauging the level of understanding, interest, and attention from the students or audience respectively.

> *"Last year, we taught a lot of workshops online. And I think we had the assumption that everybody's following along perfectly, because we couldn't see them, but the person was struggling so much. So we actually miscalculated how successful it was just because you weren't getting any negative feedback."-Codesign participant*

> *"I had no audience feedback whatsoever; it was the creepiest thing I've ever done. Because I'm like, talking at I don't know how many people? Yeah, I*

have no reactions either. It was bizarre. So I think that you question yourself, like, are they still here?" -Codesign participant

Instructors also expressed extreme frustration, finding that this type of shared intentionality blackhole significantly hindered online education for students.

"So if people are not speaking and conducting themselves and presenting themselves in a way that's professional, the basis for education is not possible."- Instructor 3

Meeting Shells

In this particular situation, one of the instructor-participants recounted an instance when, as a new employee at their educational institution, they were expected to undergo institution-mandated training. There were two (repetitive) meetings for this mandatory teacher training set-up; one face to face and one virtual. The instructor attended both respectively and found themselves to be the only attendee. There were no others and no facilitator or host at either occurrence of the training-meeting. Similar to the "student digital shell" described above, only a digital "shell" of the meetings remained, represented on the instructor's interface by a calendar invite.

At this point, there is an internal break between the institution's goals, simulation, and memory; the institution believes (and digital indication demonstrates) that the instructor's training was completed. There is also a break between the institution's goal (training its employees) and action (implementing the training) cycle, as well as a break in the information-action and internal representation feedback loops between the two agents (the institution and the instructor). This situation is a prime example of an administrative (shared intentionality) blackhole.

"But I understood it was a requirement to go as a new employee. [Researcher: Was it online or in person?] In person and then there was another one that came up that was online, which I also signed up for and showed up for. And there was nobody there. So yeah. Anyway, so I emailed the person who was sending the stuff out about it. And nobody ever got back to me." -Instructor 1

The instructor emailed the organiser of both training events, but never received a response, and so in addition to the break in feedback loops discussed above, there is a break in the communication loop, with the lack of response on the organiser's behalf. Along with these trainings never actually happening, there was also no orientation or onboarding of the instructor.

"*So I was not taught anything. I was like literally given a post it note that had the instructor login for the lectern computer. And basically told, 'Good luck.'" -Instructor 1*

Besides this example, speaking to the lack of teacher training identified in the literature (Alquraini and Gut, 2012; Anderson et al., 2007), it further burdens part-time or non-permanent instructors, who already feel they put in more time than they are compensated for with the plethora of support meetings (meetings not related to their class).

> *"There's also a lot of burden of going to faculty meetings when you're only teaching one class. The additional time of professional collaboration and stuff is a lot to ask of somebody who's getting paid minimally". -Instructor 1*

This whole experience was a waste of time and cognitive energy on the instructor's behalf and began to shape a negative internal representation of the institution's goals and values.

5.2 Theme: Bounded Rationality and Cognitive Overload

This section describes situations where too little or too much information in the feedback loops between agents in a hyflex environment can have negative effects. Too much information can cause cognitive overload (Sweller, Ayres, and Kalyuga, 2011), and constructive disengagement as a coping strategy. Both cognitive overload and actions informed by too little information in the feedback loop, are examples of bounded rationality (Simon, 1991); decision making that is satisfactory, rather than optimal.

5.2.1 Situation: Buck-Passing

A couple of instructors in hybrid work/learning environments expressed frustration trying to resolve queries, accessibility, and accommodation issues, as well as procuring available resources to support running their hybrid classes. The frustration was caused by being constantly re-directed rather than experiencing constructive actions to resolve the issue.

<u>"Error: Too Many Redirects"</u>

The instructor in this case requested a desk as an alternative to a lectern that was not wheelchair accessible. The lectern housed the computer that connected all the AV technology in the room and was essential to running a hyflex class and presenting the teaching content.

> *"The lectern is a high lectern. There's a stool that you have to climb into in order to sit at this computer, right? But initially I tried to climb up into the stool and I fell. First off, I'm 5 feet tall. OK, so even if I wasn't disabled, I'd be climbing up because I wouldn't be able to reach the computer." -Instructor 1*

Since the request was for the addition of a physical object, the instructor first reached out to the facilities department of the institution. They then informed the instructor to reach out to the instructor's department chair. The re-direction continued until the

instructor had gone through their department chair, the facilities department, the union, the human resources department, and the wellness department (since the request was tagged as a disability accommodation).

> *“Went to facilities, they said, ‘That's not our problem, and you should contact your chair’. And I'm like, well, she's aware. And she told me to come to you. And they said, ‘Well, that's not our problem’. So I reached out to the Union and they said, ‘Oh, you should reach out to HR’. I was like, great. So I reached out to HR.” - Instructor 1*

Finally in the ninth week of a fifteen-week course, the instructor received the desk, noting with irony that their “accommodation” was for “normal”, not “specialised” equipment.

> *“What gets me about the whole thing is that I need action for me so that I can teach, right. And I'm not asking for an impossible thing. I'm not asking for anything that impacts anybody's bottom line. I'm simply asking for a regular height desk and chair.” -Instructor 1*

Although the request was for a regular height desk, the categorization of the request as an accessibility accommodation influences the other agents’ internal representation (decision)-action loop. This indicated to them that it was not in their role/function to fulfil the request and it was redirected to an agent they believed were more appropriate to fulfil the request or give them permission to do so.

The lack of clarity and information on cross-departmental functions/organisational structures and roles/policies, is an example of bounded rationality (Simon, 1991) in the decision-making of acting agents. Bounded rationality states that humans are cognitively constrained, that this impacts decision making, and that higher complexity problems bring to light these constraints (on cognitive processing, for example) and its significance (Simon, 2019). In this scenario, institutional agents are cognitively constrained by the lack of information, impacting the decision to redirect the problem rather than resolve it.

> *“So the nice lady in HR who I spoke to is new. At any rate, she doesn't know the systems any better than I do.” -Instructor 1*

For new employees and instructors joining a remote or hyflex workplace, it is even more difficult to know where information should flow, as organisational knowledge is often stored in individual people’s memory, not documented externally. As Herbert Simon stated, “It is usually important to specify where in the organisation particular knowledge is stored, or who has learned it. Depending on its actual locus, knowledge may or may not be available at the decision points where it would be relevant.” (Simon,1991, p. 126).

A possible attempt at documenting where information should flow would be an organisational chart. However, organisational charts usually map out hierarchy but typically do not describe cross-departmental functions (where input from more than one

department is required to resolve an issue) or *how roles* are linked to other employees. With no external documentation to provide operational way finding and a lack of an agent's internal representation for where information should be flowing within the institution, the employee-agent in a hyflex environment makes a rationally-bounded decision that exceeds the typical bounded-rationality occurring in a traditional collocated environment.

Resources

A similar buck-passing phenomenon took place with an instructor who was trying to check out AV equipment to set up their hyflex class. The instructor was sent to multiple people/departments located in different buildings, to check out the equipment.

> "*By the time class starts, you're just, like, so tired. You're just worn down from running around trying to, like, get the equipment in place, which is actually the most simple system." Co instructor 1*

> *"They don't let you check it out for more than a single day. So if it's missing the day that you have class, then you're out of luck, even though there's [number] cameras in their inventory, but you don't wanna risk not having it available when you have class." -Co instructor 1*

The lack of procedures and policies to support the execution of hyflex classes (equipment that can only be reserved/checked on each day, not per semester) creates a mismatch between the instructor's simulation of the institution's goals (to successfully run hyflex classes) prior to the experience, and the instructor's internal representation of the institution after the constant buck-passing.

5.2.2 Situation: Student Disengagement

As mentioned earlier in section 5.1.1, the lack of student engagement was a consistent challenge in remote and hyflex classes. Student-participants noted that maintaining engagement while learning/working virtually (mediated by digital interfaces and products) was difficult because of the competing nature of perceptual cues across virtual and physical environments (demonstrated in Figure 11).

Distractions

For students attending classes remotely, objects, agents and perceptual input from their physically located environment clashes at varying intensities with information flow (objects, agents and perceptual input) from the virtual environment. For example, noisy roommates or a family-member asking the student a question while they're attending class or a meeting.

In addition to these two dominant environments competing for attention, the interface device has access to multiple secondary virtual environments, besides the students' primary virtual environment of the current class. The computer screen here acts as a

"catch-all" (Figure 15) for various notifications and applications, across work and personal environments.

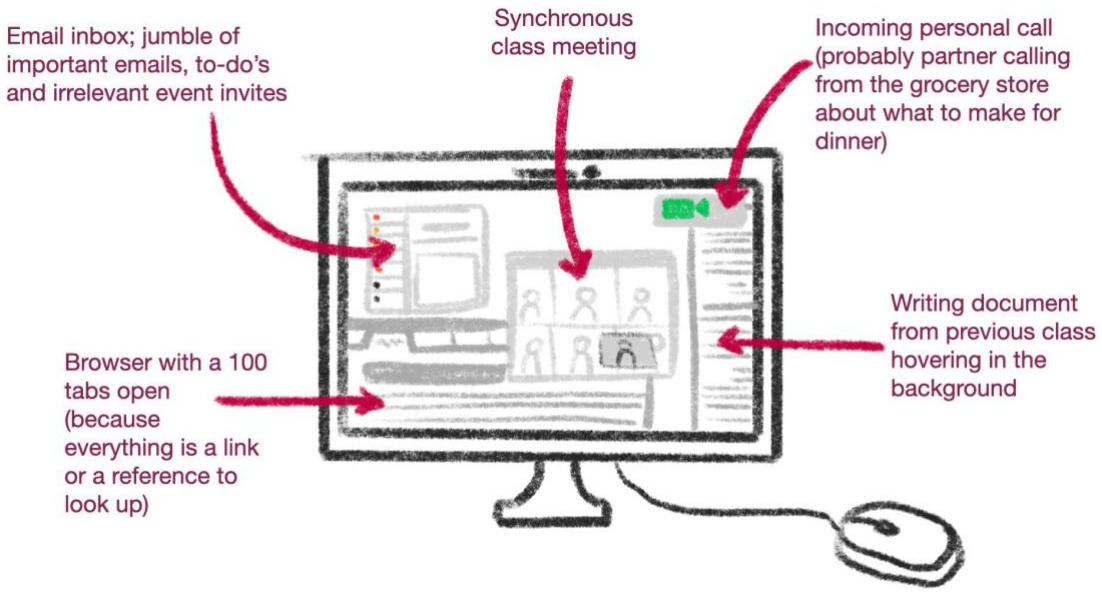


Figure 15: Computer-screen as a single portal for multiple virtual environments

While perceptual information and concurrent internal representations from various environments compete for students' attention and cognitive energy, so does multiple content input during online classes (such as side-chat banter, shared links, and resources in the chat) that accompanies the audio/video lecture aspect. The split attention principle (Sweller, Ayres, and Kalyuga, 2011) addresses this by noting that it's important for learners not to have to split their attention between many sources of information that they then need to mentally integrate.

Cluttered virtual environments

The same way a physical environment can be cluttered, so can a virtual environment. Student-participants voiced being overwhelmed by the plethora of digital tools that instructors used in varying combinations. Not only was it difficult to keep track, but students also voiced concern with the learning curves associated with new tools.

Adding to the clutter of digital tools are the multiple communication platforms (such as E-mail, Teams messages, learning management system (LMS) announcements, LMS e-mails, Discord groups, WhatsApp groups) seemingly to distinguish between tiers and types of communication (such as social/casual, formal, peer-to-peer, student-professor).

Students receive repeated messages across platforms (e.g., e-mails and LMS messages), often from groups that are irrelevant to them, yet they report they have no control about whether to opt out of institutional messaging on behalf of, or to these irrelevant groups.

“Constructive” Disengagement

The perceptual input, from competing environments and digital “clutter”, means that feedback loops are overloaded with information, resulting in cognitive overload (Sweller et al., 2011).A working explanation for this phenomenon is that agents are “constructively” disengaging (Cowan, 2022), stopping or re-allocating one’s attention from a particular environment/information loop, to manage this cognitive overload.

In remote or hybrid work/learning environments, where individuals may be more isolated and may have fewer opportunities to interact with peers, instructors and colleagues, constructive disengagement can be particularly challenging to address. It is difficult for instructors to identify when students are disengaging from what’s happening in an online meeting, and to provide the support and resources needed to help them re-engage.

5.2.3 Situation: Instructors as Simultaneous Multi-role Agents

In current models of remote/hybrid classes, instructors are required to teach (which could range from lecturing, to dialogical engagement with students, to conducting exercises or activities) organise and manage the online meeting-interface (tasks such as creating break-out rooms or trouble-shooting technical difficulties), respond to FtF (face to face) students and online students, as well as monitor the chat and respond to students via written text.

> *“There was a very, very common repetitive pattern of those of us facilitating the class in person, having to check in with people online, because there is no way of directly getting the online experience when you're in person and being able to therefore keep track of what's happening online and what's needed for that experience. So, yeah, as a TA, I was definitely finding myself being very overly concerned with like, can the people online hear what I'm saying? Can they see what I'm seeing? Can they see what's happening effectively? And there's really no way to know unless you ask and get a response” -Teaching Assistant 1*

There is an overwhelm of facilitation and teaching duties that require running concurrent communication loops, perception action loops and internal representations/simulations of both the FtF (face to face) and virtual environments, as well as the third psychological environment, representing/simulating students’ perception of their peers’ experiences (e.g., what remote/virtual students think of the FtF experience, and vice versa). This overwhelm causes cognitive overload and information to fall through the cracks.

Bad audio quality in hybrid meetings, along with other AV difficulties result in instructors having to increase their facilitation, asking students to repeat themselves or speak louder, shifting their focus from the content to how people are receiving it (simulating students’ internal representations). Instructors also found this combination made it difficult to provide real-time feedback in a hybrid meeting.

Detyna, Sanchez-Pizani, Giampietro, Dommett and Dyer (2023) also note from their testing, the high cognitive load on instructors delivering Hyflex seminars. Additionally, Detyna et. al. (2023) touch on the importance of the audio experience in the learning environment (and the difficulties in achieving high quality audio experiences).

5.3 Theme: Fostering Inclusive Environments

Situations that explicitly fostered or hindered inclusivity are discussed in the following sections. These situations include experiences fulfilling disability accommodations and resolving issues, agency to make environments accessible, advocacy and building relationships with students, observing inclusive practices being modelled and “domino” or “waterfall” accessibility. Situations regarding disclosure and perception of disability in relation to hiring processs, resources, recording classes and being “outed”, were also discussed.

5.3.1 Situation: Uncontextualized Implementation of Accessibility and Accommodations

This section covers examples that illustrate the concern of treating accommodations or accessibility as a “checklist” item, versus contextualising it in the environment, or within the receiving agent’s experience.

Instructor accommodations (built environment accessibility)

Related to section 5.2.1 (buck-passing; resolving accessibility issues), where an instructor was trying to have an accessible desk (as an alternative to an unreachable lectern) set-up in their class, we find that while the desk was finally provided, it was not contextualised to the role it was meant to play in the classroom environment (providing access to the computer that controlled the AV technology).

> *“I get to my classroom and facilities has finally (Week 9 of 15 week course) installed an accessible desk. Unfortunately, they didn't bother moving the computer, or the sound system stuff or anything over to that desk. So it's just a desk right in the middle of the (front of the) classroom.” -Instructor 1*

While the accommodation was technically provided, the accessibility issue was still not practically resolved.

> *“It's like at every step they've never thought about what logically comes next. Like, hey, let's put a ramp to the building, but let's not think about the fact that it leads to stairs.” -Instructor 1*

The lack of consideration of behaviours as a series of actions (such as ramps that lead to stairs) indicates a mismatch in the internal representation/simulation and action cycle between the instructor and the person fulfilling the accommodation.

Student accommodations

Instructors' opinions on student accommodation letters were that they provided a check-list item (e.g., extension) or "band-aid solution" for the students. They found that the lack of context on the students' diverse characteristics did not provide them with the opportunity to modify the course content/engagement styles. There is not enough information being provided for the instructor to create a robust enough internal representation, to simulate potential inclusive content/engagement alternatives.

> *"I received accommodation letters at the beginning of the semester for some of my students. And they were very, very, very light on any kind of information on how to support them. Sometimes you do need some context, right?" - Instructor 1*

> *"Which I think is another get out of jail free card because we don't actually know what the difference is to modify the course content or modify the engagement. There's no information for us to go off of in order to be inclusive. So I feel like the extension thing is not challenging for us to grant, but will a job do that for this person who will eventually have to work in the world where you have to hand things in on time?" -Co instructor*

Instructors acknowledged the tension between disclosure and privacy, but believe the current format is not a sustainable solution for students going into the workforce. They stress that not all students who may need it have accommodation letters, and that the focus should be on developing students' work/learning style as well as management and advocacy strategies.

> *"I think it's important for everybody to have as much accessibility as the students who have accessibility considerations, right? I mean everybody who needs a letter in that classroom certainly doesn't have one. And she (student) needs accommodations. And if I didn't treat her as though she did have accommodations, she would have already failed my class. But she's smart and talented. And if she can learn to manage whatever her situation is, then she's gonna be successful, right?" -Instructor 1*

> *"It would help them self-advocate for the right conditions to achieve their goals." -Teaching Assistant*

The distinction of students with or without accommodations upholds a binary perspective of students' abilities and learning styles, versus viewing students' abilities and learning styles as a spectrum of diversity. Adopting a "spectrum of diversity" approach acknowledges that strategies promoted for students with disabilities are beneficial to other students. It also begins a shift away from the medical-model of disability to the social-model and allows students to become more self-aware of their learning styles.

Interviewed instructors also noted that the online learning paradigm seemed to shift accountability of adapting to different learning styles, from the instructor to the

student, making it all the more important to focus on developing students' work/learning style and management/advocacy strategies.

> *"It is definitely more tricky to adapt learning styles when you're just doing it online. It kind of becomes more individualised to the student having to learn to adapt their own thing." -Instructor 2*

However, there are instances where student accommodation/disclosure letters help instructors interpret "signs" that may mitigate health and safety concerns.

> *"I'm trained to know what to look for in epilepsy and in beginnings of seizures. And I've managed to prevent them [student] from getting hurt so many times because I knew that that was a problem. I wasn't automatically assuming, 'Oh, they're just not paying attention' when they would just suddenly start staring into space. I knew that something was going on and so it does help to have that disclosure. I don't think that those kinds of disclosures should be a teacher limiting that student." -Instructor 2*

5.3.2 Situation: Agency over Environments

Hyflex education provides degrees of agency over one's environments, in regard to accessibility. Personal-remote environments and personal-institution environments (such as instructor-specific classrooms) provide more agency in comparison to larger institutional environments.

Remote personal environments

Instructors comparing their on-site and remote experiences, note that working remotely allows them to create an accessible environment for themselves, a strong benefit of hyflex models (Pichette et. al., 2020).

> *"The moment you take me out of the environment I set up for myself, the more the world's inaccessibility shines" -Instructor 1*

The affordances of online remote meetings, allows personalization for accessibility, as individuals can alter perceptual cues to best match their abilities. Instructors shared examples such as making elements on the screen larger and sharing documents/content before meetings (allowing screen-reader users to go through it prior to meetings, avoiding clashing audio from the meeting and screen-reader).

Classrooms; an extension of the personal environment

With the agency over many aspects of their classroom set-up, instructors are able to treat it as an extension of their personal environment. Therefore, classrooms reflected individual instructor's effort towards inclusivity/accessibility, which may not manifest at the institutional level. For example, the normalisation/acceptance of stimming behaviours by allowing "toys", providing various options for student presentations (live,

pre-recorded, etc), practices to control sensory-overload, or continuing to “illicitly” provide hyflex structured classes.

> *“Upon re-entering my 300-enrollment classroom in-person last fall, our campus told us not to offer Hybrid teaching because that would encourage too many students to not live on campus (i.e., less revenue). So, I told them I was using Zoom in the classroom to record my lectures for students who could not attend in person. But I allowed students to join my Zoom room from their home if they so chose. This "illicit" Hybrid format seemed to work very well for several weeks. About 1/3 of the students were in-person (allowing them to social-distance), about 1/3 were on Zoom, and about 1/3 watched the recordings later.” -Codesign participant*

Beyond Personal Environments

Outside of personal (physical-remote or classroom) environments, accessibility accommodations were more difficult to sustain. It seemed challenging for adaptations to institution agents’ internal representations, to be committed into its long-term memory. For example, even after disclosing a vision disability at a faculty meeting to request an adaptation to the material, the instructor found that they had to request accommodations at every subsequent faculty meeting.

> *“During faculty meetings, I don't think that the disability, like the vision, disability is very much taken into account. The print is pretty, pretty small. It can be tough to read and then I have to use my phone as a magnifier or do things of that sort.”*
>
> *“So there isn't as much of a willingness to adapt like I do in my classrooms.”- Instructor 2*

5.3.3 Situation: Personal Experiences

Internal representations and memories of past experiences create a waterfall or domino effect of inclusive and accessible motivations.

Help others by helping yourself

By tailoring the classroom environment and content to create accessible experiences for themselves, instructors can also make it accessible for students.

> “*Usually students are very accommodating (of my disability) and they actually tell me that it helps them because then they're not struggling to see the board or struggling to read the paper that I've handed to them.”-Instructor 2*

Experience with inclusivity and disability

> *“I believe that for the most part able bodied people who haven't dealt with disability directly in their lives find disability a very difficult thing to look at.” - Instructor 1*

Instructors note the difference in institutional openness and inclusivity, when agents in leadership roles had personal experiences that related to disability. Agents start to build more robust internal representations regarding inclusive and accessible practices and are more open to adapting their internal models when exposed to differences.

> *“ Um, like my principal, I know is the way that she is because her family (when she was growing up) was very open and very much willing to accept others, and willing to accept differences. She had a brother who had disabilities and so she had the personal experience with it.” -Instructor 2*

Diverse instructors have internal representations of their own experiences and challenges and are aware of potential barriers. Their past experiences allow them to run simulations of how other agents may or may not access their class/class content.

> “*The advantages to it is because I have to adapt, it makes it so that other students don’t have to tell me, ‘I can't understand what you're explaining’, because I kind of have to think about it from the disability perspective; how would I want it to be worded or how would I want the information presented to me?” - Instructor 2*

Others “see”, others do; influencing agents in shared environments

Being in a shared environment and perceiving mismatches between agent’s abilities and the environment, allows for non-didactic, sustained considerations of accessibility to be formed (through the perception-internal representation loop). In being present in a shared environment, diverse instructors found that student experiences with them and their course, changed their internal representations and considerations of accessibility and disability.

> *“I've had four, four or five students say to me that they had not considered accessibility needs in any way prior to my class”- Instructor 1*

> *“I have had students say that (my disability has affected them) … I've had a student who is now in college and who said that being in my classroom has helped them to see disability differently and not see it as a negative thing. They actually started volunteering with the disability services at their college and trying to help other students and teachers at the college level to understand disability. So kind of like becoming an advocate for disability and how students who have disabilities always end up being adults with disabilities.” -Instructor 2*

Their influence extends beyond students, to other instructors, who adopt differentiation and other inclusive practices being used by diverse instructors.

> *“I've seen other language teachers adapt my style and kind of use it. And then because teachers talk with each other, I've had teachers from other departments start to adapt the style and their classroom to that sort of style. Of course, they use their own twist to it, but they've started doing it.” -Instructor 2*

This instructor noted that the waterfall effect didn’t stem from them but extends to their past instructors whose accommodating interactions motivated them to pursue a teaching career in the first place!

> *“My French teachers when I was in high school were very accommodating to my needs and seeing how they interacted with me and seeing that teachers can make such a big difference and the difference that they made for me, made me want to go on and be a teacher myself. Um, and it made me want to have that same impact on other students”- Instructor 2*

5.3.4 Situation: Advocacy

Diverse instructors’ internal representations of their past experiences and challenges, often makes their goals/values/beliefs strongly align with advocacy roles. These ranged from formal roles (e.g., union) to informal roles (e.g., conversations between colleagues).

> *“So I am [position] of the disability caucus for the union that represents and stands up for faculty with disabilities and TAs with disabilities trying to protect you know, their identity, particularly faculty and staff that are a little bit more under kind of tenuous appointments.”-Instructor 4*

> *“The thing is, I keep stepping in, in faculty meetings where they say things about students like, ‘Oh, well, this person, you know, never hands in assignments on time. And, I know they have ADHD, but what the hell?’ And I'm like, ‘Yeah, well, you know, along with ADHD comes some pretty stunning levels of anxiety and a variety of other issues. Right. And executive dysfunction. And I guarantee that they're suffering not handing it in just as much as you are annoyed by them.’” - Instructor 1*

Diverse instructors also pushed for student accommodations, when there were no existing institutional policies, trying to best support their students.

> *“I usually advocate for it (student accommodations), but I mean, our principal is very, very understanding and she knows my work ethic. She knows very well how I engage with students. And so she as a person supports me to do these things.”-Instructor 2*

5.3.5 Relatability and Building Relationships with Students

Instructors reported that it was challenging to build trust and relationships with students due to a lack of “unstructured” time (e.g., talking between classes) for students attending remotely in hyflex environments, as well as due to “white hole” institutional messaging (messaging that was uninformed by the instructor). However, they noted its importance in being able to tailor their teaching content.

> *“And so getting to know the kind of students that I work with in that way helps so that I can be more inclusive in how I do my teaching. Um, getting to know what the students' disabilities are, what their strengths are, understanding where they struggle. Sometimes it helps me to kind of gauge, okay, how do I help each individual student to be as successful as they can be?” -Instructor 2*

Instructor-student relationships are also crucial for those transitioning out of the institution, looking for recommendation letters. Interaction with students helps instructors build a more robust internal-representation that influences their simulation and action cycle regarding students’ experiences.

> *“So my first prompt is, ‘Put an image of yourself online’. You know, so that when I go up to campus, and I see one of my students, I know who they are. And I think that it's kind of a problem for students too. Because when it comes time for students to go to graduate school, who can they ask for their letters if they've been online?”*

> *“I always tell the students to engage in office hours, whether it's in person, or whether it's online, because that is a one-on-one kind of experience. Then later on when it comes time for you to ask for a letter. You know, you've made that connection with the prof.”-Instructor 4*

Instructors found that being (relatively) open about their disability, allowed them to connect and relate with students who had a disability (and vice versa).

> *“And so it makes it a lot easier for me to connect with those students who already have a disability. Like I have a student in my class who has the same vision condition that I do…I think it makes me a more compassionate person, because I have had those struggles. I know the other side of not being able to do certain things, and so when I have students in my class who struggle, I can relate.” -Instructor 2*

Students found that disclosed instructors helped them be more comfortable about their own diagnosis and about designing solutions focused on disability.

> *“And it helps me be more open about it. Like I ended up doing, within [redacted name’s] class, an interface design for neurodivergent people. So I think that definitely made me more comfortable.” -Student 1*

While disclosure of disability has a positive effect creating shared understanding in this context, that is not always the case, as touched on in the following section.

5.3.6 Disclosure and Perception of Disability

Resources being disclosure-dependant

> *“Yeah, I mean, you have to disclose. I think that's part of it-if you don't disclose it, nobody's gonna know. And then you're not gonna get what you need. And that's one of the things about having a disability.” -Instructor 2*

Multiple instructors shared that being able to get resources (such as a desk, visually accessible material, or a classroom assistant) to support themselves, was dependent on disclosing their disability.

> *“I always have someone who's willing to help me out and go over something with me if I couldn't read it … Um, but it was very hard the first year when I wasn't as open about my disability”. -Instructor 2*

In some cases, it was extreme, such as being asked to provide a full medical history before receiving an accommodation (with no clarity as to who or where this information would go). Other experiences of “invisible” disability, or not being perceived as having a disability, also restricted access to resources and support.

> *"I'm not disabled enough to...(receive accommodations). The more autonomy they perceive on my end, the less entitled I am to accommodations” -Instructor 1*

Hiring procedures

The lack of clarity about where disclosure information goes or what it is used to inform, was also felt at the hiring and onboarding stages. Instructors who disclosed their disability at the hiring stage, received no follow-up from the Human Resources (or equivalent) department about potential accommodations.

> *“HR never contacted me. ‘You need accommodations of some kind? Or are there any accessibility issues that you may have?’ There was none of that.” -Instructor 1*

When trying to resolve accessibility issues in the workplace, the instructor was left with the impression that the institution preferred to avoid hiring people who would be unable to access the physical environment (because of disability) rather than improving its accessibility.

> *“It sounds like they may be responding to my complaints by trying to assess disability status before job offers (gasp!), which seems pretty reprehensible, if not illegal.” -Instructor 1*

Potential discrimination or targeted hiring at the time of application/hire is difficult to be certain of, as reasons behind why a candidate was not selected is not shared. Regardless, job precarity is an issue diverse instructors deal with. For example, being hired as a non-permanent part-time instructor when applying for permanent roles (after disclosure).

> *"The position that I applied for was a permanent part time position. They already knew I had disclosed through the application process and stuff, and then my teaching statement basically had a positionality statement in there. So it was pretty clear as to my perspective on disability. So she emailed me and the e-mail was basically, 'Unfortunately, we can't offer you that position. We've given it to somebody else'. And it was like, oh, well, fair enough. And she said, 'But we'd like you to apply for this other position that's coming up, which is about the same section allocation, which means about the same amount of pay, but it's non-permanent."-Instructor 1*

Being "outed"/forced disclosure

Disclosure of disability is a highly personal choice, with considerations of how it may affect current and future safety, career growth, perception of oneself by others, and building relationships with others, always at play. Most instructors found that they often disclose their disability to explain glaring differences or changes in how they do things. This could be during the hiring procedure itself, or during the start of a course.

> *"And I came into it with full disclosure because I have a movement disorder that gets worse over time. When I came to [university name] I was running I was playing tennis. I was very active. And now I'm in a wheelchair."-Instructor 4*

> *"I do disclose that I have a vision issue, so therefore my classes might be taught a little bit differently. In the sense the materials are probably going to be printed in different sizes than normal. Or the way that I write things on the board may be a little different."-Instructor 2*

While this type of disclosure is by choice, diverse instructors often have to be concerned about being "outed", especially when they see that behaviour reflected in how other instructors handle information about students' disabilities.

> *"And so unfortunately, because it's a small faculty, there's like a lot of conversation about private student issues that happens. Not publicly, but it happens widely amongst the faculty. And I find that a little distressing in places because I would hate for instructors to be discussing me in that fashion, right?" - Instructor 1*

Surveillance and recording of disability

While class recordings can be a helpful resource for students during hyflex education, there is a paralleled tension on the part of the instructor about the class recordings

being used as surveillance. The concern stems from a lack of contextualised understanding from supervisors, especially with how the manifestation of one's disability is portrayed and perceived. However, the importance of hyflex or online teaching for reaching a wider audience that may not otherwise have access to those kinds of educational resources, is acknowledged.

> "*I don't record my classes. Well, the reason why is because I have a disability that sometimes affects my speech patterns from my facial expressions. I just feel like sometimes, you know, somebody was gonna come in like a supervisor and assess a particular recording; they wouldn't really get this kind of built-up energy over time or that rapport that I have with the students. And so it's kind of a protection of surveillance. Because at first I was very, um, I felt like, the surveillance aspect was really scary to me with a disability. But now I've changed my class a little bit every time you know, and I've adapted to online teaching. And I feel like we can reach a lot of people. -Instructor 4*

On a deeply more personal (versus career) level, class recordings can act as documentation of a progressive disease, which is very taxing on the instructor to view.

> *"The first year I was so freaked out by it; so freaked out by my own video and watching recordings of myself because my disease is progressive. You know, I see myself as I once was. And so when I see recordings of myself, it's very hard to take." -Instructor 4*

<u>Victim-blaming mindset</u>

When experiences related to accessibility and disability were shared with co-workers, there was an implicit expectation of the individual to be shamed/embarrassed rather than the institution.

> *"I mentioned it in the faculty meeting the following week, and one of the instructors said, 'Ohh you must have been really embarrassed to fall in front of your students on the first day'. I was like 'No, I was embarrassed of the school'. I'm just angry for myself. I'm embarrassed for the school, right?" -Instructor 1*

The recounted experience indicates that on an internalised level, co-workers attributed the fault to the person's disability, rather than to the institution that failed to create an inclusive/accessible environment. This distinction can be classified under the two models of disability; the medical-model and the social model of disability (Oliver, 1990) discussed earlier in this paper (see section 3.1)

5.3.7 Resolving Issues

No “degrees” of reporting

Instructors feel as though there are really only two options to getting an issue resolved; a formal complaint or going through the system, the latter of which results in constant redirection (see section 4.4.1).

> *“So the whole point is to get it done and get it fixed as quickly as possible. I'm like, I don't want to file a complaint. Right. I don't want to file anything, I just want to get it sorted so that I can work in my classroom comfortably, right?” -Instructor 1*

A formal complaint is considered career suicide as diverse instructors believe it creates a negative representation of them as a “problem child” or paints them as “targets”.

> *“And meanwhile, like, I'm new. I don't want to be the problem child. You know what I mean.” -Instructor 1*

The kind of “targeting” described, touched on extreme escalation of rumoured issues and indirect communication about it that comes from the top of the chain, instead of one’s direct supervisor or manager. The pressure of the power dynamic, lack of indication of any issue prior, and uninformed (not-investigated) administrative decisions that reinforce rumours, add to feelings of being targeted.

Exhaustion with constant self-advocacy and inaccessible environments

> *“Well, colour me exhausted. Colour me disabled.” -Instructor 1*

There’s a lot of energy that goes into always being one’s own advocate and repeatedly explaining one’s disability and requirement for accommodations.

> *“You have to be your own advocate, especially in a work environment. You have to advocate for what you need and you have to be insistent in trying to explain. And sometimes you're gonna get people who don't understand. Like, there are people who don't understand how I have glasses, and yet I still have vision issues. Sometimes having to explain that to people over, over and over again. It, it can be frustrating sometimes” -Instructor 2*

> *“And when I bring it up, they're usually very good at changing that sort of thing. But it’s a little draining to constantly have to be reminded like, ‘Hey, I'm here. I have this’” -Instructor 2*

The lack of long-term change or adaptation makes facing an inaccessible environment exhausting and negatively affects the instructor’s teaching.

“So needless to say, I was quite upset and the thing is, things like that don't just like ruin my day, right? They are so physically exhausting for me that it ruins more than a day. Ruins sometimes a week, right. And it makes everything in my life harder, right?” -Instructor 1

6. Current Practices

This section details current practices in hyflex educational environments, ranging from the structure of experiences (regarding virtual, collocated, synchronous and asynchronous experiences), strategies for teaching and engagement, as well as managing resources and disability attributes.

6.1 Models of Hyflex Education

During the study, three hyflex models of education were discovered, either from interviews and co-design sessions with participants, or in the design of executing research activities. Each model has its own affordances and could be used as a best-fit approach on its own, or in combination with other models.

6.1.1 Convergent-Divergent

The convergent-divergent hyflex structure model developed in this study acknowledges the cognitive overload in sections 5.2.2 and 5.2.3, the difficulty in managing physical and virtual environments and the challenge of maintaining engagement. The focus of this model is to address these challenges without compromising the experience of any one group (virtual or FtF) .

Execution of this hyflex model requires at least two facilitators/co-instructors, as the virtual and FtF experiences run synchronously, but separately. This allows each experience to focus on the affordances of each mode and tailor materials to the advantages and constraints of each.

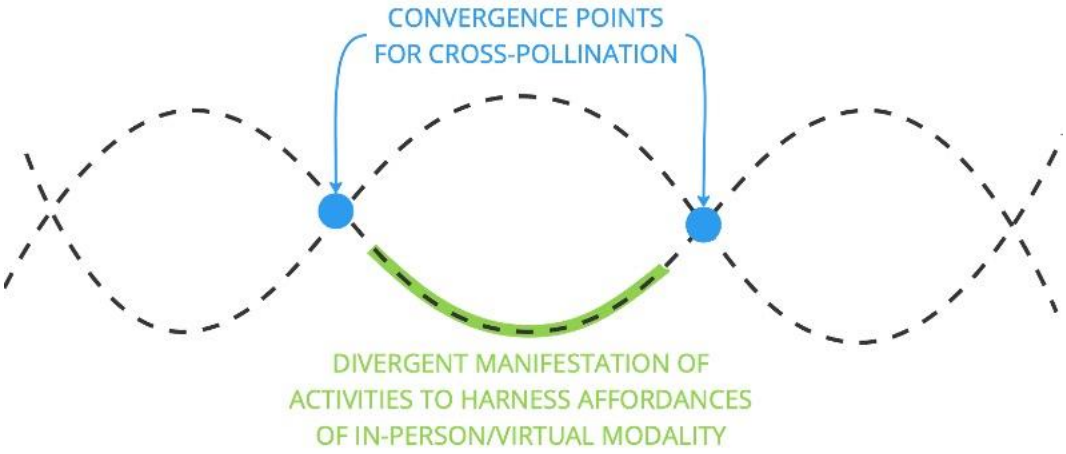


Figure 16: Convergent-divergent model for hyflex.

Convergence points are planned and designed into the experience, allowing cross-pollination of ideas from both modes. The convergence points require audio-visual technology to connect the online and FtF groups.

6.1.2 Hub and Spoke

The Hub and Spoke model (Figure 17) can be run asynchronously or synchronously, and has a central hub, with connections to multiple external hubs. The focus of this model is to cater to social, FtF (face to face) collaboration and experiences, without sacrificing flexibility or causing resource-strain.

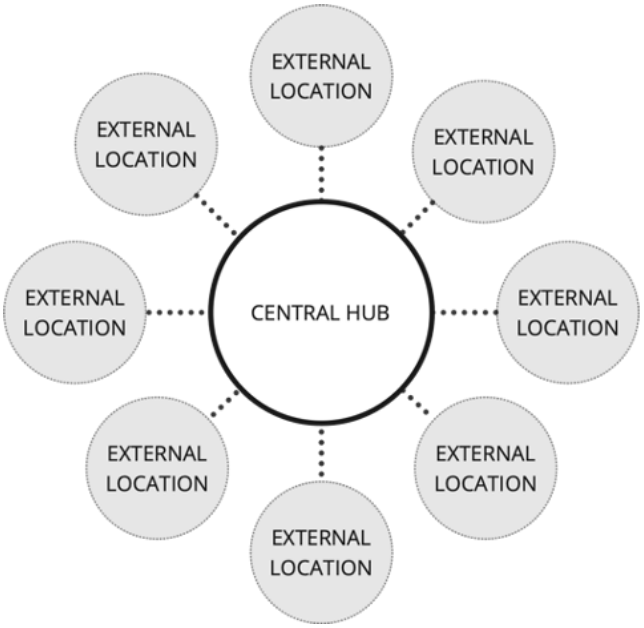


Figure 17: Hub and spoke model for hyflex.

An example of a hub and spoke model would be class being run on-site/online, with students gathering in small groups in different locations to attend virtually-together (an approach student-participants took during the pandemic). Another example is educational programming created and run at the central hub (e.g., museum), with materials shared with other community centres who then re-run the programming with local groups of people.

6.1.3 In-situ Asynchronous

This model outlines asynchronous experiences in a shared physical location (e.g., wood shops/modelling shops and museums). This model brings together the affordances of asynchronous experiences, such as time-flexibility, structured or explicit guidance, staggering of resources, and documentation, with the affordances of collated experiences, such as spatial segregation from other tasks or distractions, organic interaction with others, contextual information, and spatial familiarity.

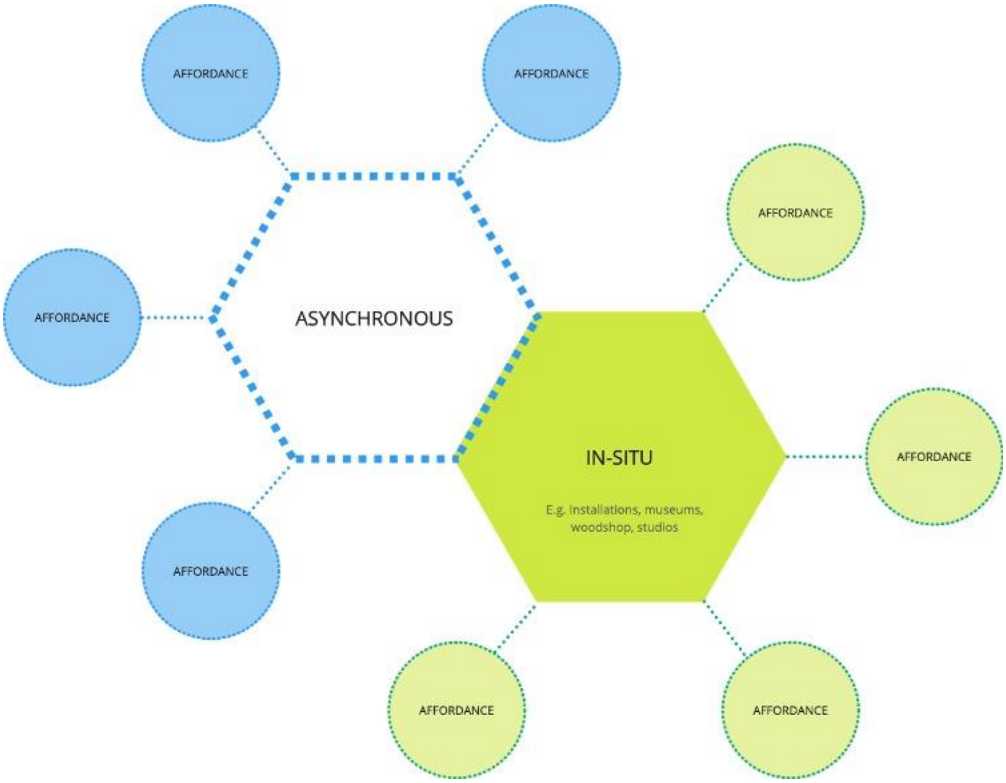


Figure 18: Asynchronous, in-situ model for hyflex.

While previously explored in contexts such as audio-tours, installations/exhibitions, and museums, it could be beneficial to (design) education to supplement shop orientations and tools, field trips, and lectures. There is also potential for virtual reality augmentation to guide experiences in the environment).

6.2 Teaching and Engagement Strategies

In order to overcome personal, technological and teaching challenges of remote and hyflex classes, instructor-participants identified the following strategies and practices.

6.2.2 Modelling Engagement and “Seeding” Online Meetings

Instructors who had teaching assistants, co-instructors, or another facilitator, would interact with them to demonstrate and model engagement and conversational behaviour, as well as break the ice when students are unsure if they should be the first one to speak.

> “*So when students aren't talking, we [TA and instructor] kind of like engage back and forth. And then you have to be okay with some uncomfortable silence”- Instructor 4*

> *“So we have the two facilitators, one will take a more forward position. So the art educator will talk about the art, and then the art instructor will take over with the art making. But they're both asked to engage with one another while they're doing that, again, to model that kind of like conversational approach”- Instructor 5*

Other strategies to break the ice included orienting discussions around tangible artifacts, such as works of art.

> *“What we do is we ask everybody to show their artwork. And that also seems to work well, because folks then don't feel like they're talking or showing themselves necessarily…I found that was also like, really, what worked with my classes. So that's why I had the co-creation/codesign so close to the front, because it got everyone into breakout rooms and talking, which is another strategy, but also that there was something tangible that they wanted to share back. And so that I think kind of broke the ice as well.”-Instructor 5*

Another strategy to increase participation was “seeding” verbal and text (chat) conversations, sometimes from a non-institutionally affiliated profile (e.g., remove institution name from virtual meeting profile).

> *“I'd be seeding the chat and I'd be seeding the conversation. So if it's like a real struggle, that's what I would recommend.” -Instructor 5*

Student-participants noted that the lack of shared workspaces in remote education, removed the perceptual engagement cues offered by other students as models, wherein other students’ work was a reference point of engagement, effort and quality of work. An element of this was brought back as instructors focused on students sharing in-progress work in class or on online discussion boards.

6.2.3 Diversifying Presentations and Methods of Engagement

Due to the reduced synchronous perception-action and communication cycles, as well as the affordances of asynchronous communication, instructors moved away from traditional perceptual cues for engagement and participation.

> *“I think that can be hard, but I have that problem in person, too. I can't look engaged, and take notes.”-Codesign participant*

Instructors had to shift to more concrete methods of gauging if students were paying attention, as “looking engaged” was no longer applicable. Examples of these methods included embedded polls, weekly prompts, reflections, or worksheets in lieu of attendance, or allowing students the flexibility to respond in any preferred manner to class content (e.g., writing a reflection, recording audio, or creating an artefact).

> *“And then the other thing that I do to gauge student engagement, is I build pages of each of my students. And then they have to update it with a prompt each week. So the prompt could be, you know, ‘Show an image of your work in progress’. Or it could be ‘What do you think about the reading in relation to mark making?’. Or it could be, ‘Share with the class, an artist that you find inspires you, either a link or an actual work.’”-Instructor 4*

Shifting through different styles of interacting and engaging online throughout one class also helped break-up the monotony that some student-participants attributed to online classes.

> *“I find it helpful to provide short intervals (no more than 30 minutes) for a specific style of interaction, e.g., lectures or tools instruction, small group activities, Q+As, topic exploration, discussions, student presentations, etc.”- Instructor 1*

6.2.4 Explicitly Teaching and Learning “Online” Skills/Organisation

With the initial shift to fully remote teaching during the pandemic, instructors felt they needed to supplement their skills, turning to video platforms like YouTube, to draw inspiration from how tutorials on the platform were set-up and executed.

> *“I watch a lot of YouTubers. And I'm not anti-YouTube, just across the board, because it's just like anything, you have to start somewhere. And you can't expect to be a good online teacher from the get go. You have to learn what works and what doesn't.” -Instructor 4*

Instructors found that they had to explicitly teach students virtual presentation and digital organisation skills, such as recording presentations and naming conventions for files, depending on which platform was being used.

> *“I walked them through how to record your presentation on Zoom. If you're just doing it for yourself, and then I walk them through how to do it on Teams.” -Instructor 1*

Specific to art and design education, instructors are more aware that the perception-internal representation loop is not direct, but mediated digitally, which influences the way the work is perceived and represented.

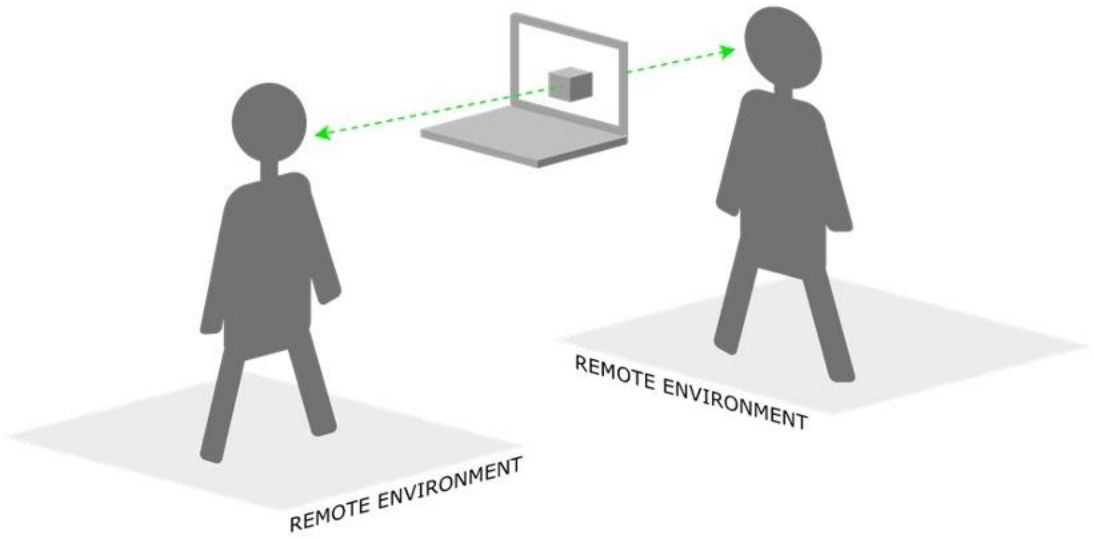


Figure 19: Digital mediation of art/sculptural objects influences perception of the work.

> *"The biggest challenge when you're looking at work online, you're looking at flattened images of work, that's actually real work. So you're not talking about, like, if it's a sculpture, you're talking about a video of a sculpture or photograph of a sculpture. So that becomes a very different kind of conversation. And also, like, one thing I go over with my students is how to colour balance images." -Instructor 4*

Instructors and teaching assistants also encouraged art/design students to focus on the quality and method of digital documentation of their work, as work was shared and critiqued digitally (even if presenting FtF).

6.2.5 Working with Disability Attributes

Instructors shared some of their current practices, "working with" their disability attributes, to plan and execute their work. One instructor describes a strong focus on auditory elements and quality, with limited speech (supported by captions) in their instructional videos.

> *"I make my tutorials there, they're kind of like ASMR videos. They don't have talking in them because my voice kind of slurs a little bit, but they have text over top. And then I slide all of the objects that they need into the frame, and I keep that kind of texture of the sound in there, because I feel like the texture of the sound makes them more of a visceral kind of experience for the student to watch." -Instructor 4 on creating learning content for their course*

Another instructor notes that their approach to work parallels their strategy to managing their ADHD; first focus on the structural aspects and then go in and execute.

> *“If there's nothing else I've learned from ADHD, you do the structural work first, and then you have a hope in hell. Otherwise, you don't.” -Instructor 1*

In terms of maintaining their own engagement in the classroom if they have back-to-back classes, an instructor describes harnessing the repetitive (but enjoyable) nature of how they experience music, by bringing in musical/song-based learning materials.

> *“I've adapted [using musical learning materials] so that it doesn't feel like I'm doing the same thing over and over again. I think part of that also comes from the fact that when I listen to songs, I listen it to it on repeat” -Instructor 2 on maintaining their own energy/engagement in the classroom*

In the case of multiple disabilities (with one being related to chronic pain), an instructor shared how the intense focus of ADHD helps mask attributes of the other disability.

> *“One of the superpowers of ADHD is being able to be very hyper focused and so a lot of time I'm able to actually do things. And not really notice that they hurt until much later. And I regret it for a long time. But that's that's my life, you know, it's how I roll.” -Instructor 1*

6.2.6 Accessible and inclusive design

Accessible design tools

One of the student-participants shared that they were introduced to a MakeCode (Microsoft, 2023b) micro-processing board as an alternative to other micro-processor boards during a remote interaction design course. They found the MakeCode board to be a more accessible design tool than other micro-processing boards. This was because it was financially accessible, having a lot of in-built sensors that would otherwise have to be purchased to extend capabilities of other boards like the Arduino Uno. The included capabilities also enhanced the opportunity for multi-sensory design, an approach to designing products that are more inclusive (Lupton and Lipps, 2017; Malnar and Vodvarka, 2004).

With its ability to toggle between block-based coding, Python and Javascript, the MakeCode board provided entry-points to students at different programming levels to participate in the course. The student-participant found that they were not held back by syntax errors, as they previously were, and that having a “digital twin” (defined in this study as a virtual replica of a physical object that simulates the physical object’s behaviour) of the hardware components made it easier to collaborate with other remote students (this feature is also available for Arduino Uno boards, on TinkerCad.com).

Accessible content

Some instructors were aware of students’ cognitive overload as they were overwhelmed with institutional communications (see section 5.2.2) and made sure they paid attention

to how course information was structured and shared. Importance was given to having information related to the course (e.g., assignments/syllabus), institutional policies (e.g., academic integrity), and best-practices (e.g., file-naming conventions) all linked to a central virtual location. Additionally, the information was organised in “chunks” and scaffolded to help ease cognitive overload.

> *“And it's broken up into little chunks. You don't have to read it all at once. It's all very ADHD and autism accessible and all that stuff. And it's also like basic mental capacity accessible from my perspective.” -Instructor 1*

Incorporating inclusive and accessible design considerations in courses

The diverse instructors that were interviewed described embedding accessible considerations (such as contrast values) in their teaching, and even created courses around accessibility/inclusivity.

> *“And so, like, I'm like, you know, you need to print out your stuff in black and white so that you can see the colour values, right? And make sure that there's enough of a contrast so that as many people who can actually still read with their eyeballs, can read it.” -Instructor 1*

> *“So I'm teaching 2 concentrations for the third years, and in one of them I've decided I'm doing an accessible wayfinding system as research and development for the university. And because that would be great, right? Because then the students get the perk of having a real project that gets produced and it benefits the university.” -Instructor 1*

The pattern of findings indicate that students found diverse instructors included content/concepts that were not taught in other courses they experienced, such as cross-sensory approaches, different ways of information processing and embodied interaction.

> *“There's so many concepts that were touched in that course and just like never again in other courses.” -Student 1*

The interviewed student also indicated that the inclusion of teaching assistants from different fields of expertise (e.g., sound design and engineers) and guest lectures who had lived experience with disabilities, constructively shaped their learning and design direction for their final project.

> *“Diverse TAs and guest lecturers provided different fields of expertise and taught us how to have engineer-designer conversations, which is usually an industry pain-point.”*

> *“My first picture had perspective, but after learning that perspective, especially for a person that's completely blind doesn’t really make sense to represent ‘cause perspective is purely like a visual thing, that changed even the type of artwork that I did. So I moved even more abstract.” -Student 1*

6.2.7 Intentional Choices with Software Technology

Some instructors noted that they were deliberate about where they chose to host their instructional content, not just defaulting to institutionally chosen platforms, as they were concerned about protecting their intellectual property. Previous research on online education (before and during the COVID-19 pandemic) indicates that this is an ongoing concern with the affordances of a digital modality (Reese, 2015; Khan et. al., 2022).

> *"And I also post my demos on Vimeo just because I want to control my own intellectual property." -Instructor 4*

Other examples of intentional choices with software, included creative "repurposing" of software such as using Google Earth or Google Maps to build narratives or practice language skills.

> *"…creatively using Google Map, where they'll [students] go onto street view and they'll go to places in [country] and then they'll pretend they're walking and find a shop somewhere and try to explain to me how their conversation would go with someone there." -Instructor 2*

6.3 Building Support Systems

Diverse instructors share how they mitigate some of the challenges they face by creating a system of support around them.

6.3.1: Colleagues and Teaching Assistants

<u>Colleagues</u>

With the constant effort of self-advocacy in non-accessible environments, instructor-participants share how colleagues as advocates on their behalf, really helps.

> *"So the other faculty member who isn't in my faculty, she was so upset on my behalf that she actually went down to the service desk and harangued them and got like all kinds of people's phone numbers and e-mail addresses and stuff." -Instructor 1*

Instructor-participants also shared that the lack of accessible faculty meetings is less-bothersome since they've built relationships with colleagues who help them access the content/resources. They also believe that their reputation for good work helps mitigate the negative perception of accommodations.

> *"It doesn't generally bother me, especially now that I've built really good relationships with the people around me. I always have someone who's willing to help".*

> *“Okay. They need a little bit extra in this area to be able to do great work, but if we give them that, they’ll go above and beyond” -Instructor 2, describing receiving accommodations.*

However, they noted that these relationships and reputation took time to develop, more so with virtual-remote interactions than FtF-collocated interactions. This was attributed to reduced perceptual information and communication when in differing environments.

Teaching assistants

Teaching and classroom assistants were instrumental supports for diverse instructors, who found that being able to distribute some coordination and technology responsibilities, avoided making them the single point of failure, and allowed them to focus on teaching.

> *“So that I don't have to carry it [camera] in every day and so I am not the single point of failure. Right. Because if I'm coming from another meeting or if I'm ... But management is reducing me to a single point of failure.” -Instructor 3*

However, it is often challenging to hire individuals that instructors already have a working relationship with, in these support roles. Even though accommodations allow them to select the person, they’re often on the receiving end of someone random, usually at the last minute, which doesn’t allow time for course-planning.

> *“So then ultimately [person] intervened and they allowed us to follow the rules.”- Instructor 3 talking about how they finally received the support they needed.*

6.3.2: Storing Resources

With remote and hyflex teaching, institutions believe that there is no longer a requirement for consistent on-site space for instructors and have shifted to a hotelling model. This means that there were no on-site storage spaces for AV equipment or other resources, and instructors turned to co-opting TA/student lockers.

> *“I was like finally victorious with the camera and then we had nowhere to store it and then it was like this whole other hurdle of the lockers…All we needed was the camera to be stored in some location where everyone could access it, but it's not set up to do so.” -Co instructor 1*

With no secure or permanent space, expensive equipment was often carried back and forth.

> “*I was carrying two laptops and the camera, like, every week. I mean, I was like a pack mule. It's like I'm a factory worker and I gotta carry my own toolbox into the factory”. - Instructor 3*

Integrating the importance of teaching assistant support-systems and resource storage, instructors note that non-permanent and sessional instructors are less likely to get the support they need because of the way on-site storage is set up for them.

> *“Yeah, they're very inflexible in that. If you are a sessional instructor, you can only get access to a locker with a physical key, like it's not set up to have TAs or CAs come in and grab equipment. There's no support for that.”- Co instructor 1*

7. Codesigned Solutions

This section documents some of the relevant outcomes from the seven codesign sessions conducted with the students, instructors, and remote workers with accessibility needs. Most of the co-designed concepts focus on the interaction with and role of technology in hyflex environments.

7.1 AV and Spatial Synchronicity to Increase Engagement

From the observed hyflex undergraduate course, two key aspects were brought to attention. First, sharing audio and video of the co-located students in the physical classroom to those attending remotely was limited by one-directional microphones and cameras, and on the dependence of students to bring in personal devices (to connect to the virtual class). Second, that the classroom was set-up with long tables that went down the length of the room, and that students gravitated to the back of the class.

To address the first issue, we introduced the use of a document camera to share drawing techniques and an Owl camera (Owl Labs, 2022) that had a 360° camera and microphone, as well as an integrated speaker. The Owl camera provided a panoramic view of the room, as well as focused the camera on whoever was speaking at a certain time.

Over the course of the term, we codesigned a variety of technical and lay out set-ups to improve the experience and engagement of students, in the following combinations:

	Classroom set-up	**AV set-up**
12th September 2022	Two rows of long tables	Individual Devices
19th September 2022	Two rows of long tables	Laptop, external microphone, and projector (TA’s laptop). Document camera (instructor’s laptop

26th September 2022	Two rows of long tables	Owl Camera and projector (TA's laptop). Document camera (instructor).
17th October 2022	Amphitheatre/semi-circle desks	Owl camera in centre of desks connected to projector (TA). Document camera (Instructor)
7th November	Desks in clusters/groups, 1 student at each cluster, except 1 table with 3 students (who seem to be prior friends)	Owl camera in front corner and projector (TA). Document camera (instructor's laptop)

Table 2: Technical and layout set-ups of semester-long course

In line with 'Behaviour Setting Theory' (see Section 4.1) that states that the environment or arrangement of a space can afford or hinder individuals' behaviour (Baker, 1968), the different classroom set-ups elicited different behaviours from the students. We found that the set up with the long tables, regardless of which AV set-up was used, resulted in very low shared intentionality and engagement.

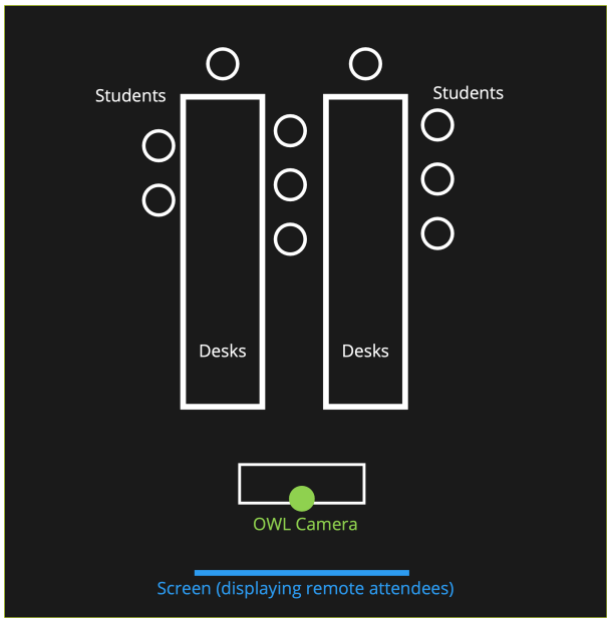


Figure 20: Visualisation sketch of the classroom with two long tables.

The most successful set-up that increased shared intentionality, and consequently engagement and participation, was the semi-circle/amphitheatre set-up. Desks were arranged in two rows of semi-circles, with FtF (face to face) students at the desks, the OWL camera and microphone was at the front, with a projection screen of remote attendees behind it, facing the students (Figure 21).

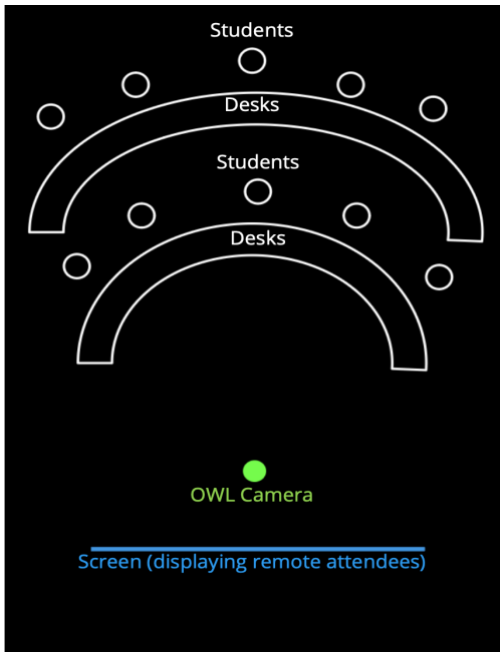


Figure 21: Visualisation sketch of semi-circle classroom layout.

The initial motivation behind the change was to better map the physical set-up to reflect the OWL camera's panoramic view. However, we discovered that it also made students less distracted, more participatory, and more engaged in the class content.

7.2 Feedback Indicators on Digital Interfaces

7.2.1 Indications of Technical Difficulties

Codesign participants brainstormed interface icons to decrease the shared intentionality blackhole created by a loss of perceptual cues when an individual is going through technical or connection difficulties during an online meeting. Although participants acknowledged that long-term solutions require large-scale infrastructural intervention (e.g., to provide strong, consistent WiFi for all), the indication of limited bandwidth or technical difficulties on one's meeting interface would definitely help ease the cognitive strain and facilitation duties of meeting attendees and provide clarity on the lack of response from online attendees.

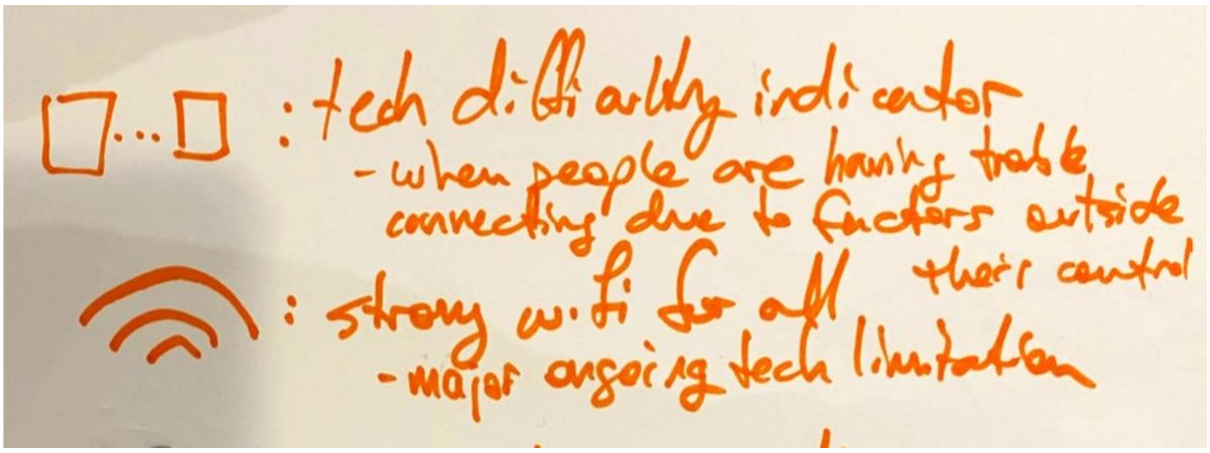


Figure 22: Codesign participants' interface icon brainstorm.

7.2.2 Auto-Redaction

To address the tension between privacy and participation during recorded classes, codesign participants brainstormed an auto-redaction feature that could be added to current meeting interfaces. While current online meeting interfaces notify attendees when a meeting is being recorded, one can either choose to accept and stay in the meeting, or decline and leave the meeting, therefore missing out on the class. The proposed solution would allow students to still attend and participate in the class, while opting out of their video and/or audio being documented in a recording of the online meeting.

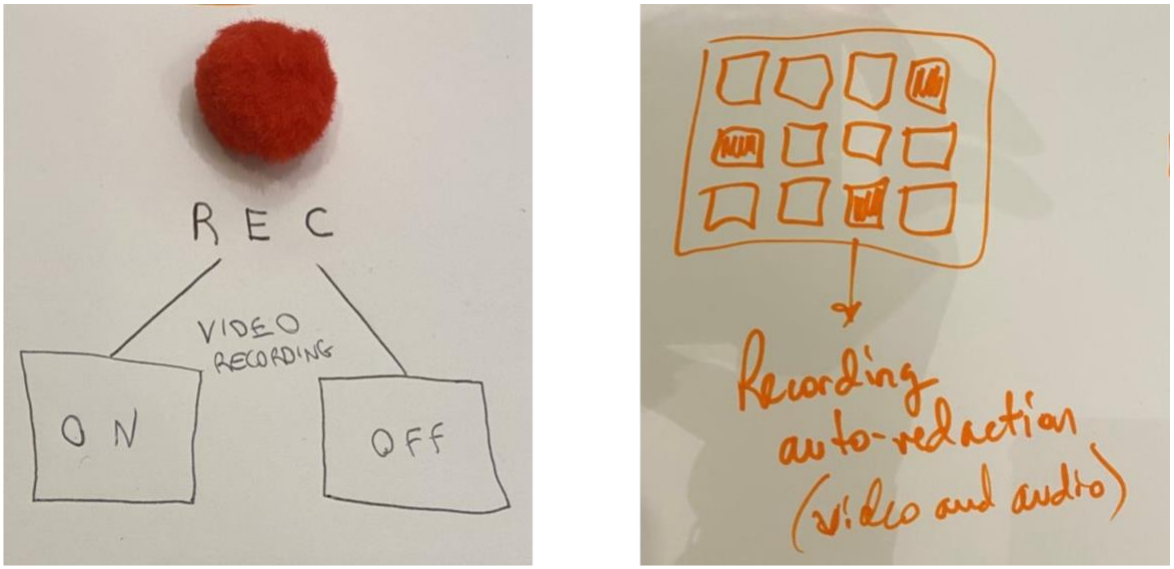


Figure 23: Codesign participants' auto-redaction concept.

7.2.3 Visual Avatar

In order to provide attention and engagement feedback through visually perceptual cues, without the need to prescribe to the binary of camera off or on, codesign participants proposed the idea of an “auto-avatar”. At the time of the codesign session, this feature did not exist. However, since then, Microsoft has released an avatar feature on its online meeting platform, Teams (Microsoft, 2023a).

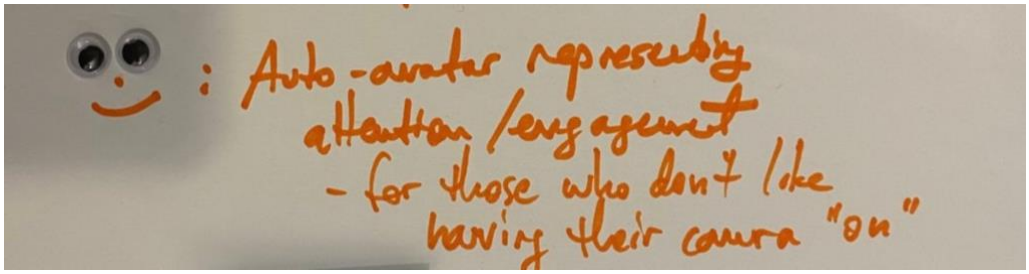


Figure 24: Codesign participants’ “auto-avatar” concept.

7.2.4 Artificial Intelligence Feedback and Prompts

Visual feedback (facial expressions, eye-movements, body language and gestures) from attendees is important to instructors/presenters trying to maintain attendees’ engagement. However, the visual perceptual cues may not be available to instructors who have a vision impairment or are BPSI (blind or partially sighted), and a virtual avatar (see section 7.2.3) may not address the pain point.

As an alternative, the idea of harnessing that perceptual data without having camera output resulted in this prototype (hyperlinked to video). The prototype illustrates the concept of using artificial-intelligence facial recognition to provide real-time feedback and suggestions to instructors.

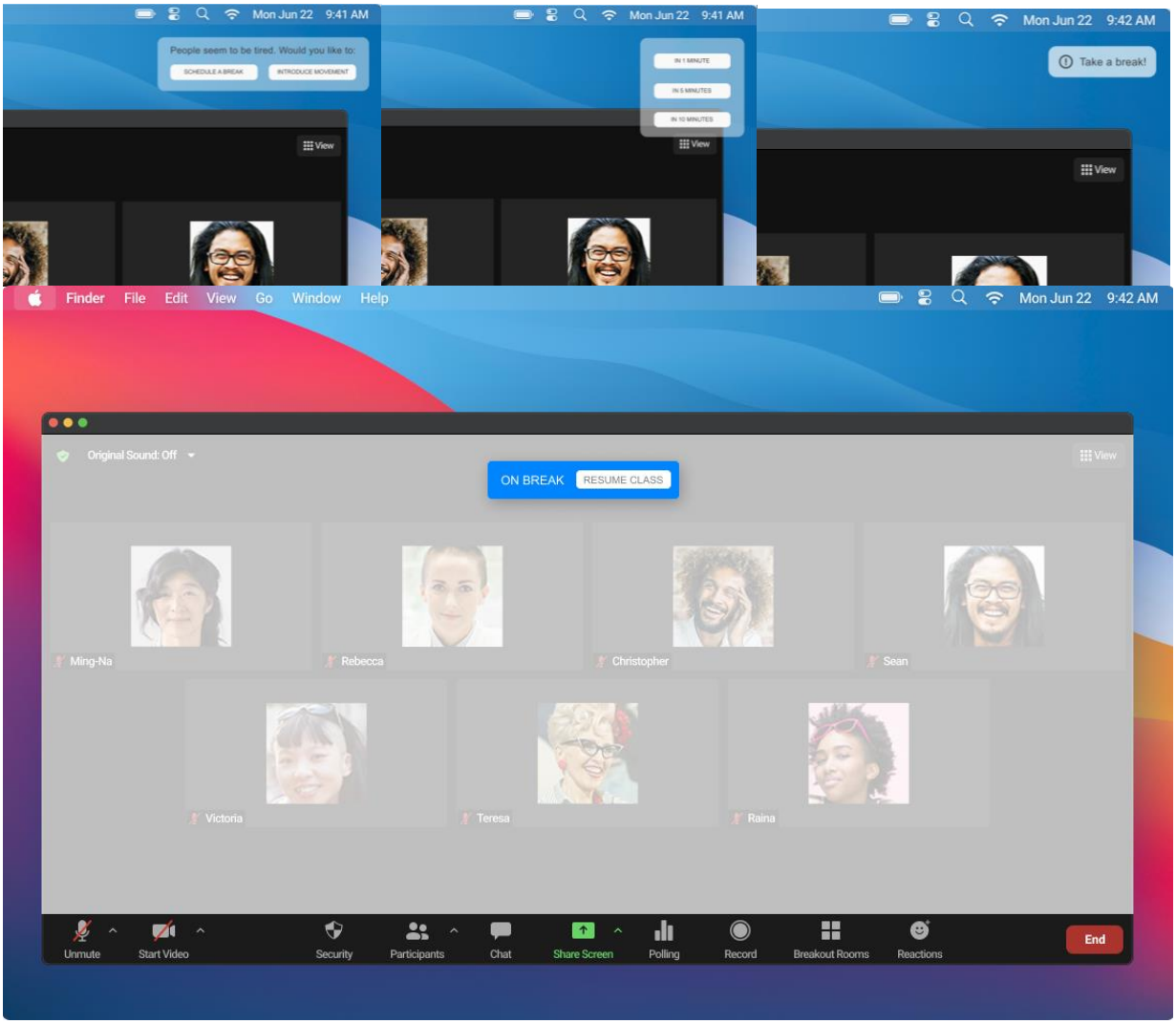


Figure 25: Image sections from video prototype, showing notifications and suggestions based on AI facial recognition from meeting attendees.

7.3 Personalization Through Aggregation

7.3.1 Aggregation of Digital Tools

Student participants found it difficult to keep track of the many digital tools and combinations of tools that each course/professor required. Students that were more mature in age also expressed they needed more onboarding time for unfamiliar tools.

By introducing a “digital tools” feature into the course structure, instructors would be required to be more intentional with their chosen tools, students would be able to review course tools in advance and get familiar with them, as well as easily reference an aggregated and hyperlinked view of institution-wide, course-specific, and personal tools. The three levels of tool-categorization are comparable to those identified in Basham et.

al.’s, digital backpack concept: foundational technologies, modular technologies, and instructional technologies (Basham, J.D., Meyer, H., Perry, E., 2010).

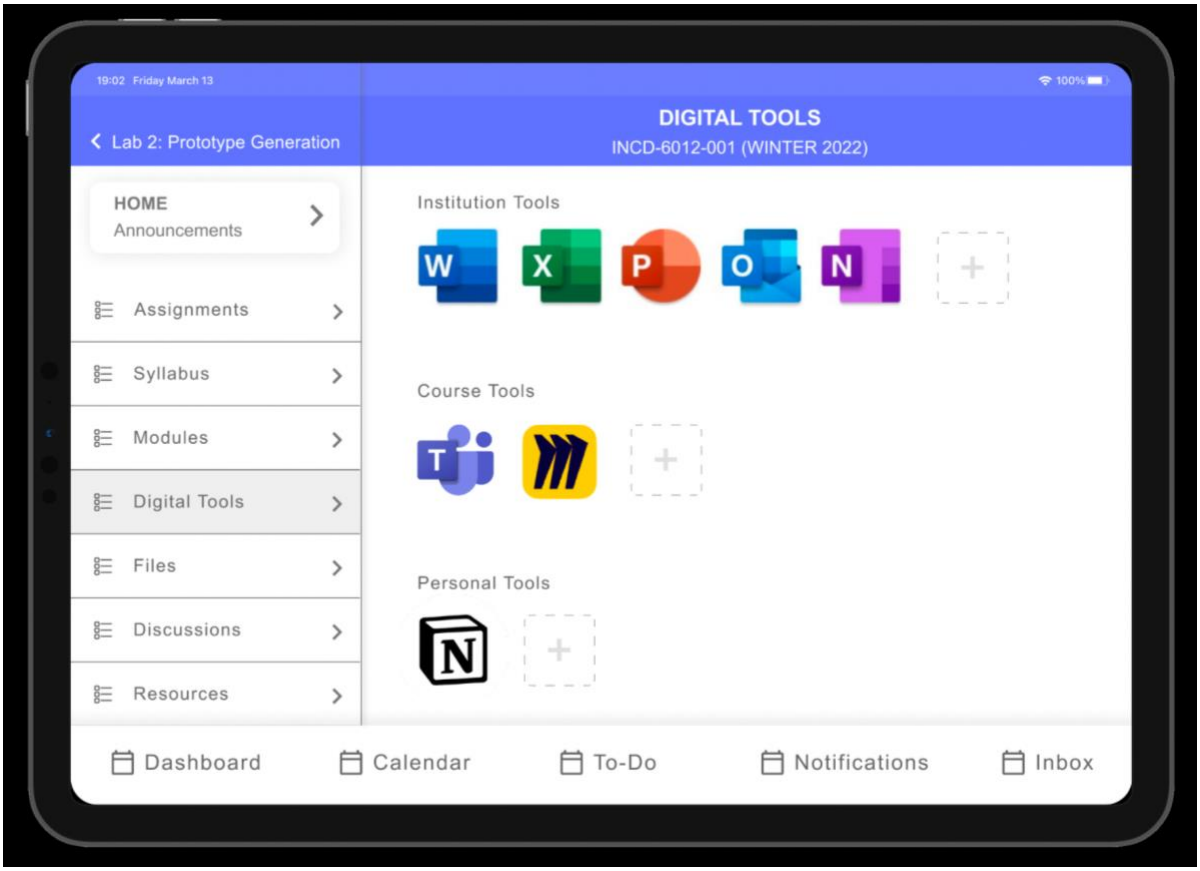


Figure 26: Addition of a “digital tools” feature to Canvas/Instructure LMS.

7.3.2 Creating Virtual Workspaces

Participants often needed to find information across platforms/tools, whether it was an assignment description on their learning management system, something in a constantly updated team document, checking the time zone of a remote team member before messaging them or even just making sure to balance their personal and work calendars. By allowing them to aggregate these and personalise a dashboard with widgets, they can tailor it to their needs and create (virtual) spatial segregation from multiple virtual environments.

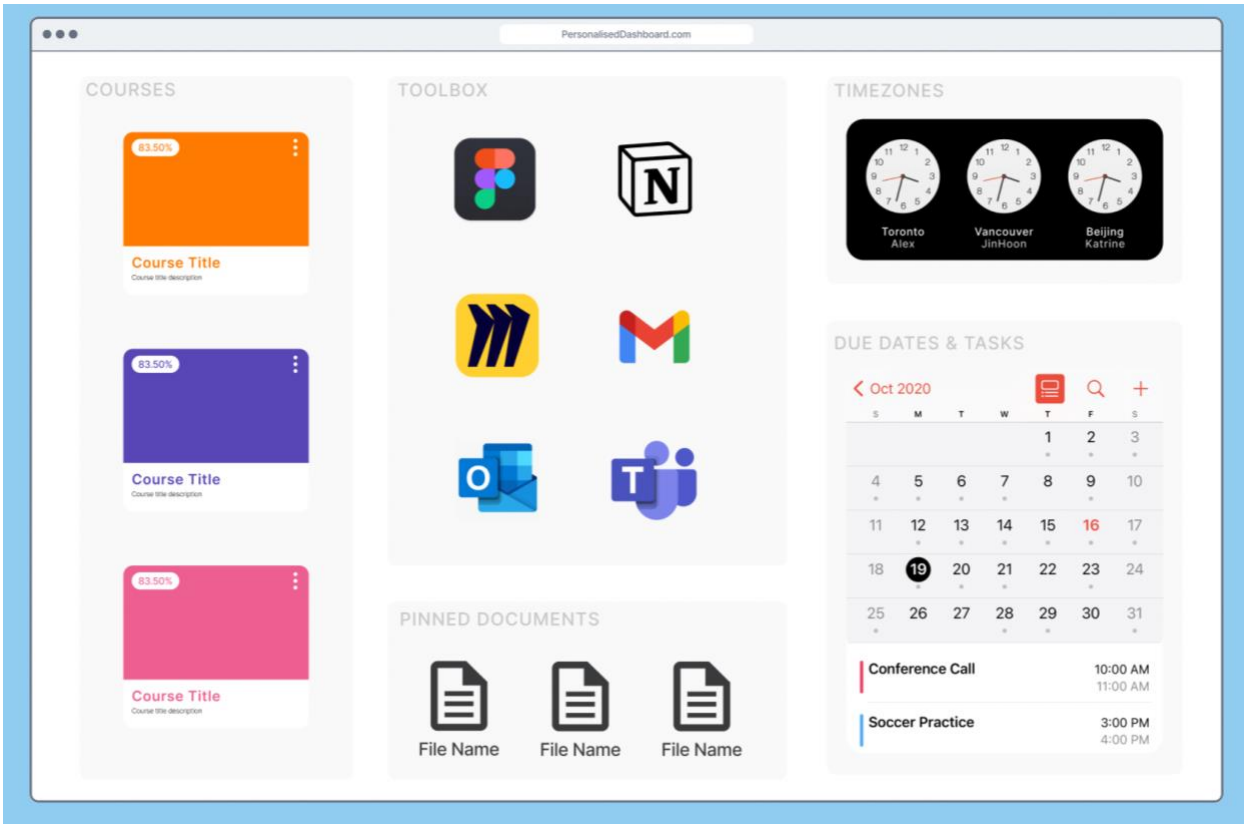


Figure 27: Customised dashboard of aggregated virtual software and widgets to create a virtual work environment.

7.4 Tangible Controls and Interfaces

7.4.1 Tangible “Tokens” for Different Workspaces

Building on the idea of creating spatial segregation from multiple virtual environments, was a concept to link different workspaces to physical tokens. Placing a physical token on some kind of sensor, would trigger a particular virtual environment to open (e.g., “job” or “school” or “social”). This concept could be linked to the personalised dashboards outlined in section 7.3.2

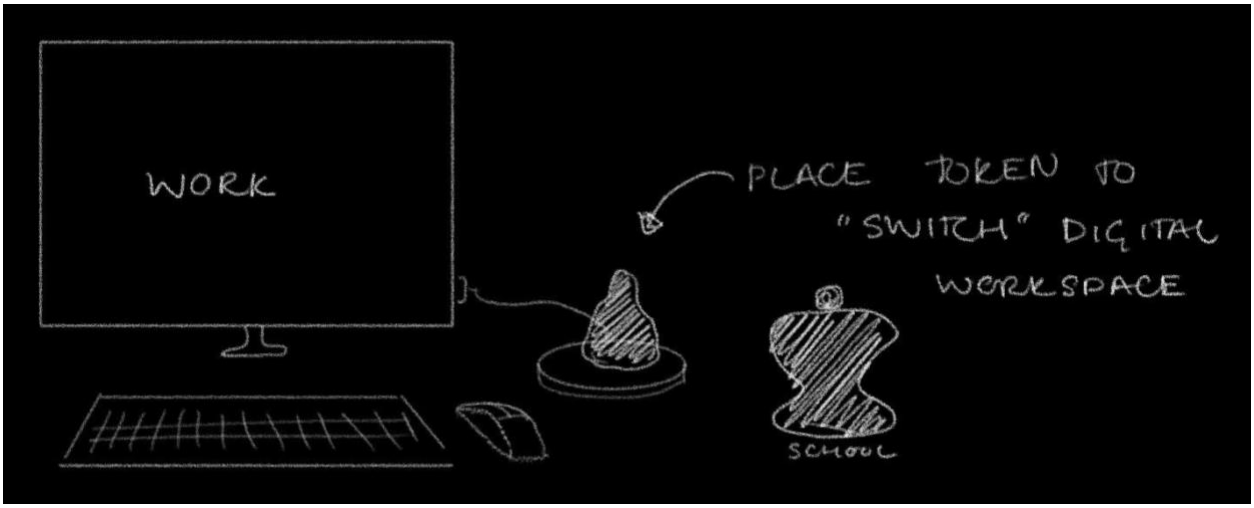


Figure 28: Visualisation-sketch illustrating a physical token being placed on a pad linked to a computer. One token is attributed to a "work environment" and another to "school environment".

7.4.2 Tangible User Interface (TUI) for Customised Audio Control

This concept focused on addressing the audio experience of an online meeting and the need for sensory control. The codesign participant in this instance was BPSI and therefore audio was a key part of their online meeting experiences.

Each of the circular pieces in the centre represent a meeting attendee and the two grey circular pieces on either end represent volume control and mute options respectively. The location of the meeting-attendee LEGO pieces is meant to distribute that audio-source spatially, while the volume and mute buttons can control one's experience of individual audio sources (e.g., increasing the volume of a soft-spoken person).

Figure 29: Codesign participant's LEGO prototype of tangible audio controls for virtual meetings.

7.4.3 TUIs for Collaborative Digital Documents

Software like Google Docs, which were key tools for remote/hyflex collaboration, did not provide a good experience for screen-reader users accessing features like comments or indicators of collaborators. Participants expressed frustration with the current experience of their screen-reader announcing every-time a colleague entered the shared document, or moved to a new line/paragraph, as well as announce each instance a new comment was added, along with the contents of the comment. Current controls provide a binary option to have screen-reader integration on or off, causing most people to work on the document on “off hours” when others were not working on it.

This prototype from codesign participants illustrates a tangible interface, where locked paragraphs were indicated by yellow pipe-cleaners, and the pink spheres were indicators of team-members. Touching these aspects on the TUI would announce the collaborators name or read the beginning of a locked paragraph. The intent of this prototype was to provide a degree of choice versus binary (not completely on/off) and provide more agency and control interacting with collaboration features.

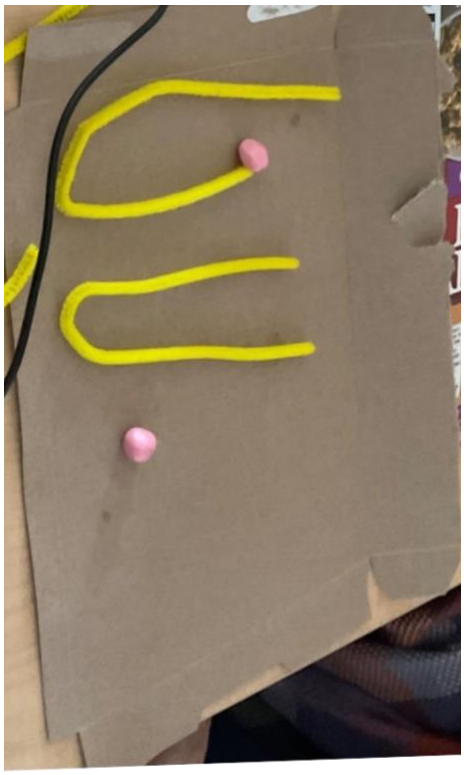


Figure 30: Codesign participant’s tangible interface prototype for collaborative documents.

7.4.4 Modular 3D Diagram

This prototype showcases the use of metaphor and tangible collaboration as a way to facilitate shared representations. Codesign participants who collaborated to create this, noted they would be able to come back, orient themselves (catch up/understand what’s

changed) and work on it asynchronously, because of the tactile nature and initial synchronous engagement. This corresponds to one of the engagement strategies (section 6.2.2) shared by an instructor who oriented initial activities around tangible things to increase engagement.

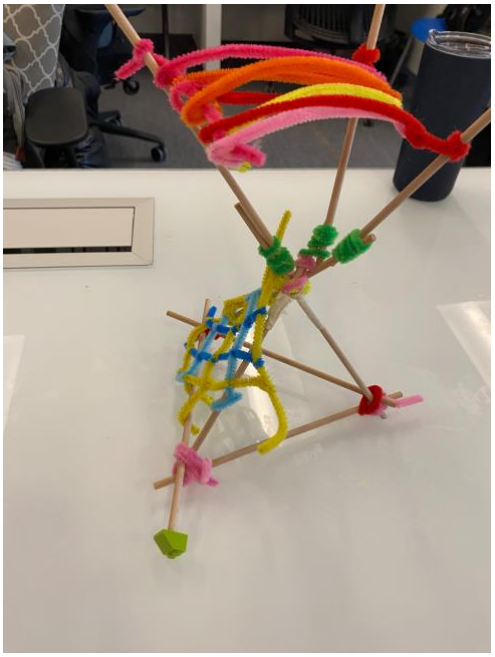


Figure 31: Prism-based structure made of wooden sticks and attached by pipe cleaners. On the structure are clay modules, a netted surface on the left side and a canopy on top made of pipe cleaners.

7.5 “Internal” Wayfinding

This codesign session focused on prototyping a way to resolve issues by providing employees with an internal wayfinding tool to mitigate the experience of buck-passing (see section 5.2.1). The tool would highlight gaps and provide more transparency and accountability in regard to policies, roles and job duties, and clarity on procedures.

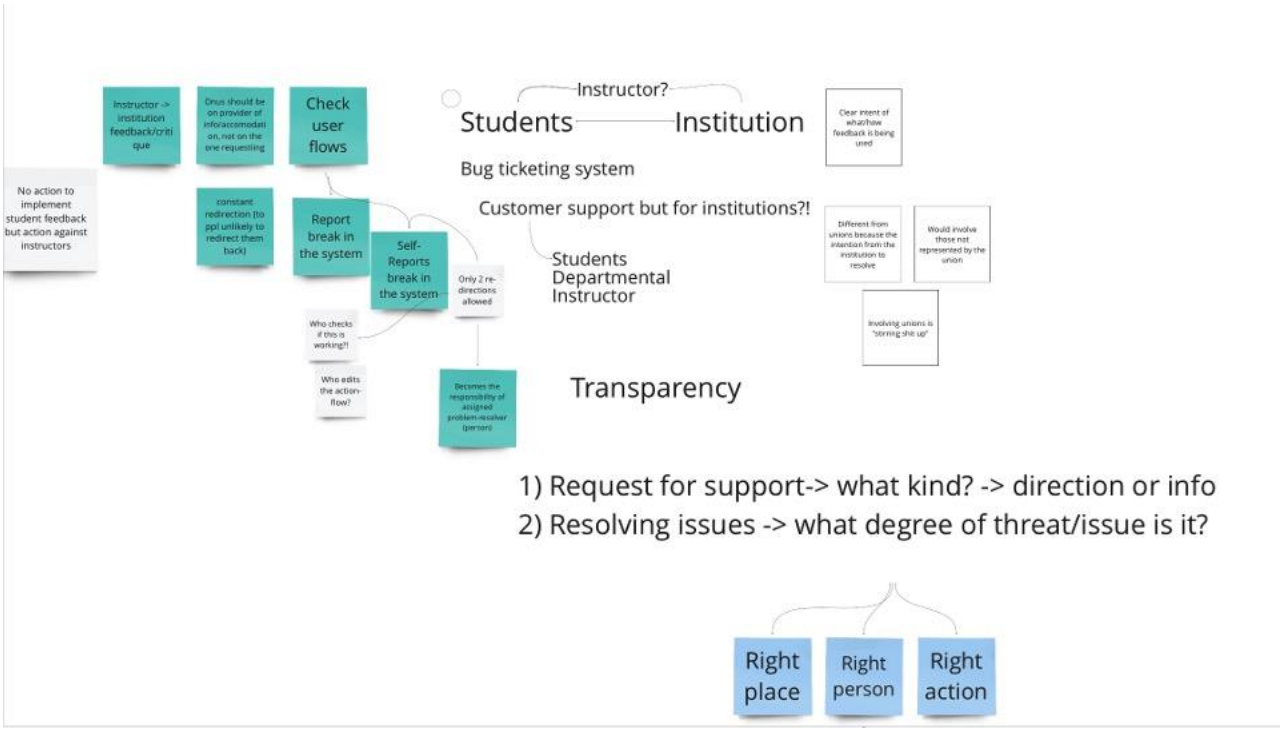


Figure 32: Codesign participants' outline of a tool for "internal" wayfinding.

One of the key considerations of the internal way-finding tool was a "self-learning" ability to adjust its direction depending on (a) the correct place/department (b) the correct person/role and (c) the right action. If all three conditions were met at the end of the employee's experience (e.g., directed to the correct person, in the correct department, and the task was resolved), then it would be marked as successful, and it would use that to direct the next person that comes with the same request.

Another concept explored was to provide a template to document employee journeys through different tasks (e.g., checking out AV equipment, resolving an accessibility issue) to identify bottlenecks and cross-departmental functions. Four rows are indicated, where the first is for the instructor or employees' action. The following three rows indicate different departments. The actions and decisions taken to resolve the instructor action (issue) is mapped across these rows, depending on the involved departments.

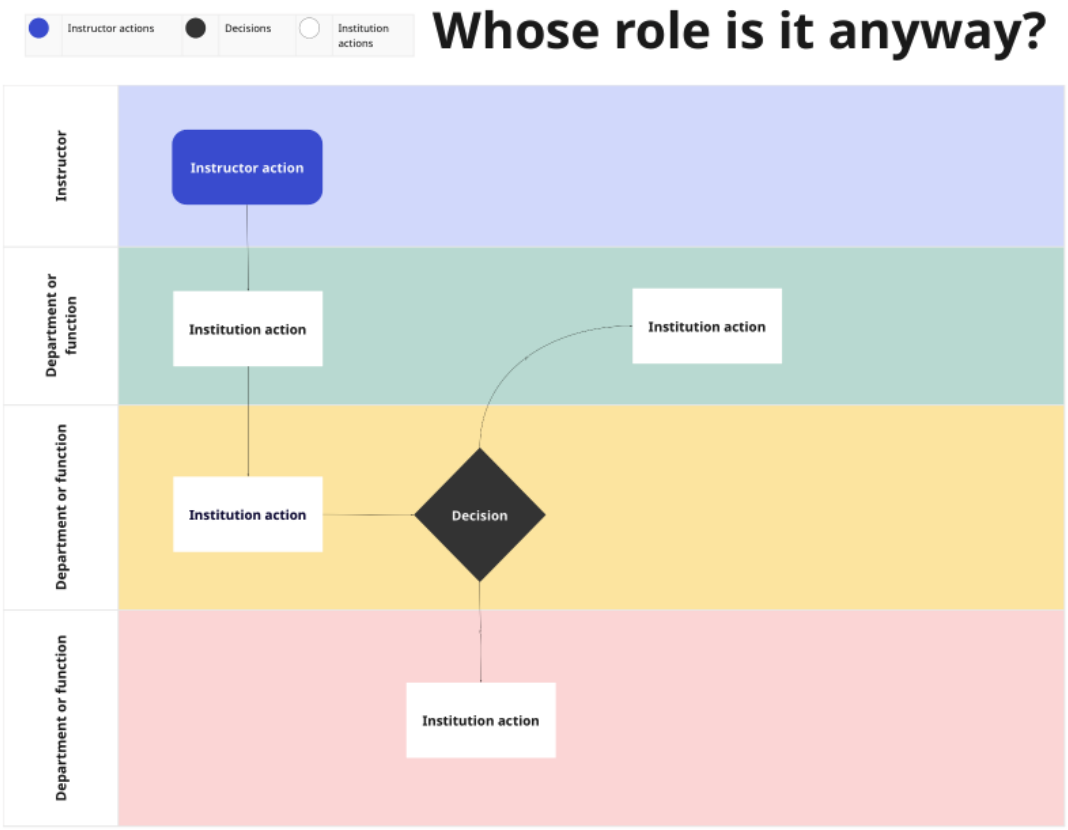


Figure 33: Template to document employee user-journeys.

8. Discussion

The findings from this study suggest a causal pattern; in some instances, an effect is due to multiple causes, and in others, a single cause has multiple effects. To aid the ease of comprehension, these correlations along among solutions (codesigned artefacts and current practices) are presented in the table below.

Causes	**Effects**	**Solutions (codesign & current practices)**
No feedback	Digital shells	Visual avatar; AI feedback; Auto-redaction; Icon of technical difficulties; Diversifying presentation and methods of engagement
Bounded rationality	Buck passing	Internal “way finding” tool
Distractions; Multi-role instructors; Digital clutter	Cognitive overload; Student disengagement;	Intentional, creative software choices; Models of hyflex experiences; Modelling engagement and “seeding”; Teaching “online” skills;

	Constructive disengagement;	AV and spatial synchronization; Tangible “tokens” for workspaces; Aggregating digital tools; 3D modular diagrams
“Outed” and forced disclosure; No degrees of reporting; Surveillance and recording of disability; Potentially discriminatory hiring procedures	Job precarity	Intentional choices to record/ not record and store instructional content
No agency over environments; Resources being disclosure dependent; Uncontextualized accommodations; Victim blaming	Hinders inclusivity and accessibility	Co-opting teaching assistants’ lockers for onsite storage; Building relationships with students; Agency over personal-remote environments
Agency over environments; Building relationships with students; Observing inclusive practices	Fosters inclusivity and accessibility	Building support systems (colleagues and teaching assistants); TUIs for customized audio control and collaborative documents; Implementing inclusive and accessible considerations, content and tools, in
Previous experience with disability/diversity	Advocacy; Relatability with students; Domino accessibility and inclusivity; Openness to inclusivity/difference	Working with one’s disability attributes; Implementing inclusive and accessible considerations, content and tools, in courses

Table 3: Summary of findings in a causal pattern

Within the findings from “current practices” and “codesigned solutions” sections, there’s a link between inclusivity/accessibility and engagement. Current practices or codesigned solutions to increase engagement like modelling dialogical engagement (section 6.2.2) or feedback indicators (section 7.2), would also be an inclusive practice for those that may not be able to “read” emotional or social cues (reflected in the experiences of people on the autism spectrum, for which modelling is already a utilised strategy [Delano, 2007]). Current practices or codesigned solutions to increase inclusivity/accessibility, such as internal wayfinding (section 7.5) or TUI (tangible user interface) for collaborative documents (section 7.4.3) have potential to increase engagement in the form of collaboration and cooperation.

8.1 Findings and Shared Intentionality Black holes

The study covered many different instructor and student experiences, that can be categorized into the following main themes. (1) **Cognitive overload** (which includes the findings of multi-role instructors, distractions, digital clutter, student disengagement); (2a) **Agency over environments** (which includes the findings of accessibility in personal versus institutional environments and lack of resource access or storage); (2b) **Resolving accessibility challenges** (which includes the findings of buck-passing, bounded rationality); (3) **Limited agency over disability information** (covering findings related to a lack of clarity on trajectory and impact of disclosed information, as well as surveillance/recording of disability); (4) **Personal experience informs current inclusivity** (which includes findings such as advocacy, openness to difference, observing and implementing inclusive practices); (5) **Lack of feedback/response in virtual environments** (covering findings of digital shells).

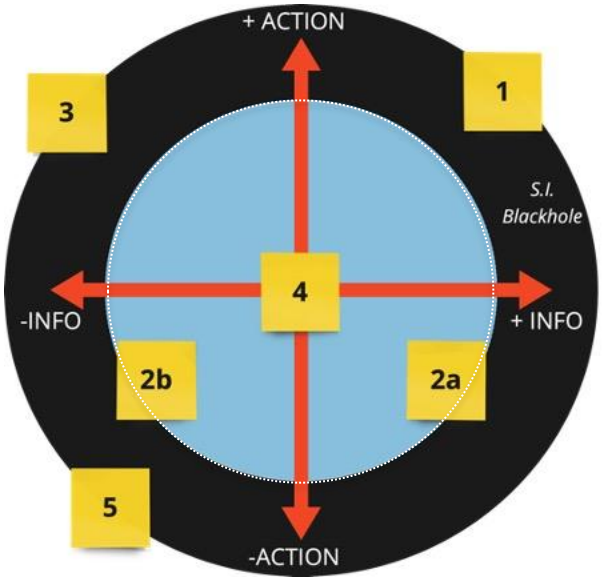


Figure 34: Mapped themes on SI blackhole model indicating the degrees of fostered SI

The main themes from the study were mapped on the *SI Blackhole* model (originally presented in Figure 13), indicating the degrees of fostered shared intentionality in relation to the saturation of information-action cues flowing through feedback loops in the hyflex environments (Figure 34). Themes 1, 3, and 5 (cognitive overload, limited agency over disclosed disability information, and the lack of feedback or response) were clear SI Blackholes. Themes 2a and 2b (agency over environments and resolving accessibility challenges) were on the cusp of becoming SI blackholes (near the event-horizon). Theme 4 (personal experience informs current inclusivity) indicated situations that effectively fostered shared intentionality.

8.2 Implications and Significance

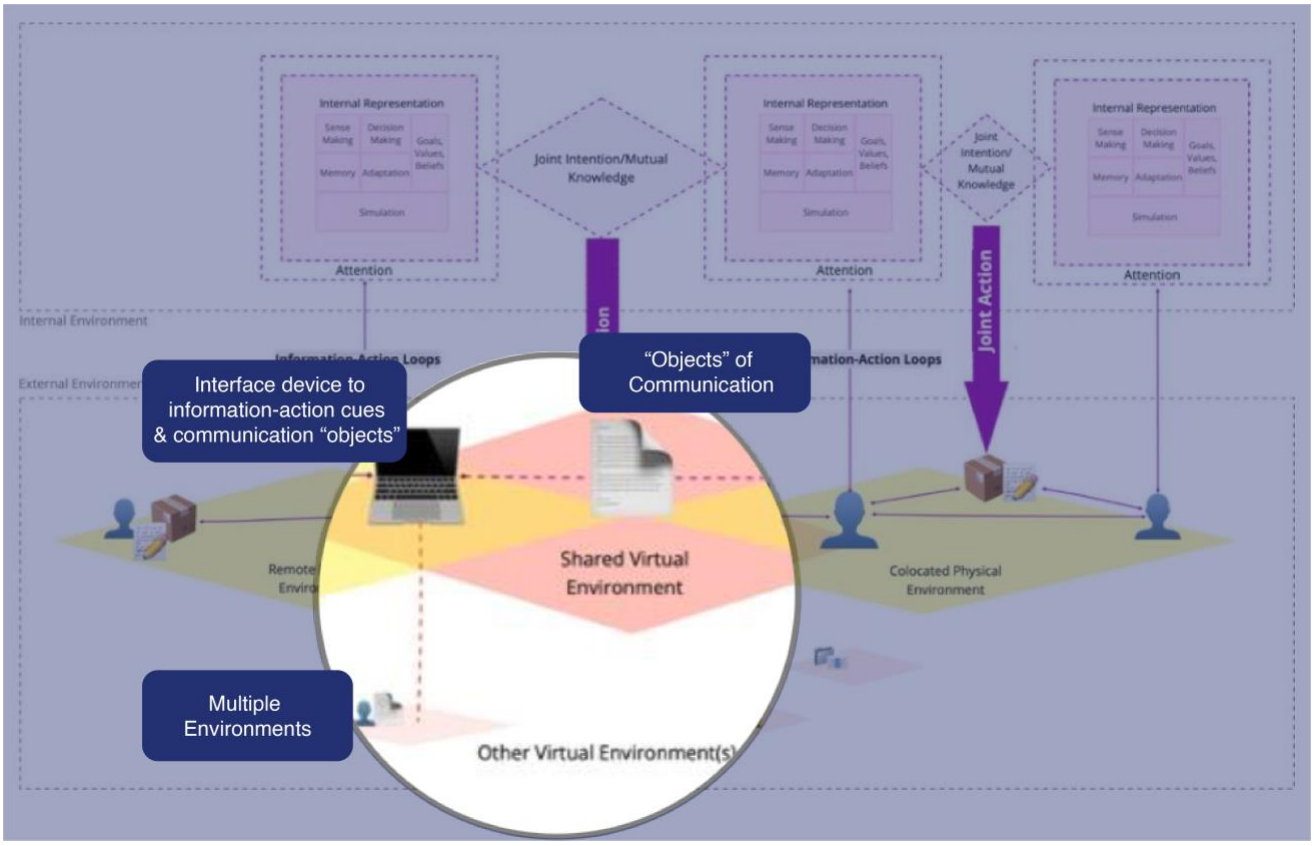


Figure 35: Key aspects of hyflex environments

Overall, the experiences shared document tensions between the various environments (external, internal and virtual), regarding attention, collaboration/cooperation, communication and information flow. To tie back to concepts from the literature review, behavioural settings for FtF education and work have had decades to develop and evolve. So has online/virtual education (albeit not to the scale or intensity brought upon by the COVID-19 pandemic), and we as a society are still developing virtual behavioural settings. I would argue, however, that hyflex behavioural setting for work/learning is **currently being defined and created by various cultures of practice (**socially constructed by locally defined groups).

The findings from this study begin to outline two key considerations for hyflex learning and working, (1) all the involved environments must be integrated, but also able to work independently and (2) the affordances of having "objects" (that can be manipulated) of communication (Blanchard, 2004). To put this in context of the findings, codesigned solutions like "AV and spatial synchronicity" indicate that the virtual environment, and co-located physical environment need to be better integrated (see also Detyna et. al., 2023). Additionally, the need for feedback indicators that are independent of available

perception-action cues (section 7.2.4) also points to the consideration of integrated environments, still being able to work independently. **The integration of the different environments in hyflex education, means that these environments, its objects and related perceptual cues, need to be accessible individually as well as collectively.**

Organisation and architecture of the virtual environment (through codesigned solutions such as creating virtual workspaces and aggregating digital tools in section 7.3), show that **virtual work environments are not yet being designed as their own *space/place*** (there is a distinction here between virtual work environments, that are currently culminations of various communication and collaboration software, and virtual reality environments, that are actually designed 'spaces'). Similar to the development of spatial definition in physical behaviour settings (Moore. 1986), spatial definition in hyflex behaviour settings also has scope to be developed. For example virtual breakout rooms are equivalent to putting up solid walls to delineate space, whereas technologies like spatial audio can help create different "spaces" (equivalent to delineating space with permeable boundaries, like rugs or lighting).

The codesign solution "internal wayfinding" (section 7.5) indicates that procedures and policy-information needs to be made available in a way that is accessible in both environments, and indicates a need for organisations to be **intentional and clear about *where, how, and with whom* communication "objects" are stored.** This is also apparent in the lack of clarity about where, how and with whom, disability disclosure information pertaining to instructors and students are stored. The affordances of communication "objects" that can be manipulated (shared, cut, paste, etc.) also brings about questions of instructor's protection of privacy and intellectual property.

Along with the opportunity for research into hyflex behavioural setting theory, there is also a design opportunity for hyflex tools, to aid collaboration in hyflex environments. For example, physical tools like micro-processing boards that have "digital twins", allowing use of the tool in a physical or virtual environment. Other codesigned artefacts also indicate an opportunity for increased accessibility of virtual collaboration tools, such as digital whiteboards or Google Docs.

8.3 Universal Design and Hyflex Experiences

As per my argument that hyflex behavioural setting for work/learning is currently developing, there is scope to provide suggestions to aid this development. These suggestions relate to Universal Design/ Universal Design for Learning (UD/UDL) guidelines to include recommendations that are considerate of all the environments (remote, collocated, physical or virtual) involved in a hyflex model.

The reason behind using UD/UDL as an underlying framework along with evidence from this study to inform recommendations, is the overlapping focus on engagement, perception, representation, communication, and action (CAST, 2018a, 2018b). Since UDL aims to increase cognitive and pedagogical accessibility and is informed by brain

research (Rose, D. H. & Meyer, A., 2002, ch. 2), there is a strong connection between UDL and this report's conceptual model (section 3).

The table below outlines the link between UDL and cognitive networks (Rose et. at., 2002, Ch. 2) and the cognitive science concepts presented in the report's conceptual model.

Cognitive network; purpose	**UDL focus**	**UDL guidelines**	**Related aspect of conceptual model**
Recognition network; receive and analyse information	Representation; "What" of learning	Perception, language and symbols, and comprehension	Information (perceptual) loop
Strategic network; plan and execute actions	Action and Expression; "How" of learning	Physical action, expression and communication, and executive function	Internal representation (simulations) and information (perception-action) loop
Affective networks; evaluate and set priorities	Engagement; "Why" of learning	Interest, effort and persistence, and self-regulation	Goals, values and beliefs

Table 4: The link between UDL and cognitive networks

The table below, maps how specific Universal Design for Learning Guidelines (CAST, 2018a) relate to hyflex education, through evidence from this study.

	UDL Guideline	**Evidence**
Engagement	**Optimise individual choice and autonomy (7.1)**.	Models of Hyflex Education-choice of synchronous/asynchronous and virtual/FtF (section 6.1); "illicit" hybrid (section 5.3)
Engagement (internal representation)	**Optimise relevance, value and authenticity (7.2)**.	Constructive disengagement (section 5.2.2); Personal experiences with disability (section 5.3.3); Student-instructor relatability (section 5.3.5); Advocacy (section 5.3.4)

Engagement (perception)	**Minimise threat and distraction (7.3)**	Student disengagement/distraction (section 5.2); Auto-redaction (section 7.2.2); Tangible “tokens” for workspaces (section 7.4.1)
Engagement (internal representation)	**Heighten salience of goals and objectives (8.1)**	*(Adapted to include salience of most relevant shared environment)* Tangible “tokens” for different workspaces (section 7.4.1); Creating virtual workspaces (section 7.3.2); AV and spatial synchronicity (section 7.1); “Seeding” virtual meeting chat (section 6.2.2)
Engagement	**Vary demands and resources (8.2)**	MakeCode-levels of programming expertise as well as virtual and physical prototyping tools, scalability with additional sensors (section 6.2.6); Models of Hyflex Experiences (section 6.1(
Engagement (internal representation)	**Foster collaboration and community (8.3)**	Internal way-finding tool to guide where and how to receive support (section 7.5); Clarity on expectations of roles within a group/department/institution (section 7.5)
Engagement (self-regulation)	**Facilitate personal coping skills and strategies (9.2)**	Student accommodations (section 5.3.1); Working with disability traits (section 6.2.5)
Representation (perception)	**Offer ways of customising the display of information (1.1)**	Personalised dashboards (section 7.3), Auto avatars (section 7.3.1, 7.3.2)
Representation (perception)	**Offer alternatives for auditory information (1.2)**	Captions in instructional videos (section 6.2.5); Prototype to control individual audio+spatial audio (section 7.4.2)

Representation (perception)	**Offer alternatives for visual information (1.3)**	Google doc TUI (section 7.4.3)
Representation (internal representation)	**Activate or supply background information (3.1)**	Relatability and disclosure (section 5.3.5 and 5.3.6); Feedback indicators in digital interfaces (section 7.2)
Action/ Expression	**Vary methods for response and navigation (4.1)**	Diversifying presentation and methods of engagement (section 6.2.3)
	Optimise access to tools and assistive technologies (4.2)	Buck-passing, resources (section 5.2.1); Resources being disclosure dependant (section 5.3.6)
	Build fluencies with graduated levels of support for practice and performance (5.3) ● **Differentiated mentors** ● **Differentiated feedback**	Involvement of TAs from different backgrounds (section 6.2.6); Resolving issues, no “degrees” of reporting (5.3.7)
	Facilitate managing information and resources (6.3)	Obtaining and storing resources for hyflex (section 5.2.1 and 6.3.2); Organisation of course information (section 6.2.6); Building interfaces to facilitate management of virtual resources (section 7.3, and 7.4)

Table 5: Evidence-based suggestions informed by UDL guidelines.

The table below, maps broader Universal Design Principles (Mace, R., Hardie, G., Place, J., 1991), to evidence from this study and provides suggestions for Hyflex Environments.

	UD Principle	Evidence	Suggestion for Hyflex
Equitable Use	Provide identical or equivalent means of use and access	MakeCode micro-processing board (section 6.2.6); Convergent-Divergent model (section 6.1.1)	(1) Provide “twin” (identical or fraternal) experiences for tools, procedures, and information across hyflex environments (virtual and physical).
	Provisions for privacy, security and safety for all users	Auto-avatars to interact without videos on (section 7.2.3); Feedback indicators on digital interfaces (section 7.2); Vimeo vs LMS for instructional videos to protect IP (section 6.2.7); Clarity on purpose, storage and distribution of disability disclosure information (section 5.3.6)	(2) Explicit and implemented policies for students and staff about class recordings, intellectual property, as well as storage, distribution, and possible manipulation of communication objects. (3) Integrate feedback indicators that do not encroach on participants’ privacy.
Simple/Intuitive Use	Provide effective prompting and feedback throughout the stages of a task	Student shells and meeting shells (section 5.1.1); Feedback indicators on digital interfaces (section 7.2); Internal way-finding concept (section 7.5)	(4) Balance formal/informal and passive/active feedback points during classes (communicate formal feedback points at the start). (5) Verify execution and log feedback for institution events/training. (6) Internal search or directional tool to guide employees to correct department/role as well as opportunities for cross-pollination across the institution.

Perceptible Information	Communicate information effectively (mindful of different ambient condition or sensory abilities)	TUI for collaborative documents (section 7.4.3); TUI for customisable audio (section 7.4.2); Feedback indicators on digital interfaces (section 7.2); Accessible content (section 6.2.6)	(7) Augment or supplement communicated information with multi-sensory options whenever possible. (8) Evaluate tools for accessibility experience and make collective decisions about virtual tools before starting a task. (9) Provide opportunities for individuals to adjust perceptual information on micro and macro scales (e.g., individual's audio or overall audio in virtual meetings). (10) Scaffold and chunk information.
Tolerance for Error	Arrangement of elements (most used should be easily accessible, while irreversible actions should be shielded)	Aggregation of digital tools (section 7.3.1); Agency of environments (section 5.3.2)	(11) Create space for personalisation, while maintaining structural consistency across the institution.
	Provide fail safe features	Building support systems (section 6.3.1)	(12) Identify and mitigate single-point failure systems (people or technology). (13) Develop opportunities for cross-pollination across the institution to encourage social support systems.

	Discourage unconscious action in vigilant-oriented tasks	Uncontextualized implementation of accommodations (section 5.3.)	(14) Encourage contextualised/integrated rather than checklist implementation of accommodations (e.g., decision trees) while aiming for more sustainable or long-term solutions.
Low (physical) Effort	Minimise sustained (physical effort)	*(Adapted to cognitive effort)* Multi-role instructors (section 5.3.2); Distractions, virtual clutter, constructive disengagement (section 5.2.2)	(15) Provide facilitation support whenever possible. (16) Encourage/explicitly teach students how to minimise digital distractions and clutter. (17) Create structures/scheduling for institutional communication (e.g., 8 am and 5 pm)

Table 6: Evidence-based suggestions informed by UD principles.

8.4 Limitations

The study conducted had some limitations in its methodology. Firstly, the students from the observed class have not yet been interviewed, as there was no confirmed interest of participation after recruitment materials were shared. Inclusion of students from the observed context could have provided valuable insights and validated/invalidated observational notes. While there is scope for the continuation of this study to incorporate these students, as of this report, the full range of experiences and perspectives may not have been captured.

Secondly, the study did not involve running co-design sessions with instructors and their own students together. While this was intentional in consideration of the power dynamic between instructors and students, involving both parties in the codesign process could have provided more balanced and comprehensive solutions or ideas from their combined input.

The study also does not go in-depth into language accessibility, which is a significant limitation for some users. For example, the study does not address the accessibility of virtual environments for users who rely on sign language or lip-reading.

Additionally, the study did not evaluate or test all codesign solutions/artefacts or current practices for effectiveness. This is especially important for contexts with clashing accessibility requirements. For example, while the visual avatar codesign (section 7.2.3) concept could help overcome some concerns, the implications of it on language accessibility was not considered.

Therefore, while the study had its strengths, it also had several limitations in its methodology, including the lack of student interviews from the observed course, the lack of co-design sessions with instructors and their own students, exploration of language accessibility, and comprehensive evaluation of co-design solutions. These limitations should be taken into consideration when interpreting and applying the study's findings.

9. Conclusion

The literature review section identified a significant gap in the literature pertaining to instructors with disabilities, particularly in the context of remote and hyflex environments. Limited literature was found on this topic, with no other research specifically addressing instructors with disabilities in remote and hyflex settings.

This study has filled this identified gap by shedding light on the experiences and perspectives of diverse instructors in remote and hyflex environments. The study has provided valuable insights into the challenges and opportunities faced by these instructors, their positive impact on students, as well as the strategies they employ to navigate the unique demands of teaching in hyflex settings.

By exploring this previously unaddressed area, the research has contributed to the understanding of the intersection of disability and remote and hyflex teaching. This study hopes to inspire further research and discussions on how to better support instructors with disabilities in remote and hyflex environments, expanding the scope of inclusive education to instructors.

There are several areas for future research that can build upon the findings of this study. Firstly, evaluating the prototypes and UD/UDL-based suggestions can provide insights into their effectiveness. Usability testing and feedback from users can help refine these prototypes and suggestions, ensuring that they are optimised for inclusivity and effectiveness in hyflex environments.

Secondly, there is a need for the development of accessible collaborative tools specifically designed for virtual and hyflex modes of teaching and learning. This could involve creating or modifying existing tools to ensure that their accessibility features are easy to use and intuitive. With the clear indication of sensory and cognitive overload in virtual environments, there is a strong indication that these tools should be multi-sensory.

Lastly, investigation and documentation of the two key considerations of hyflex experiences identified from this study, is crucial. Regarding integration of different environments while maintaining their independent functionality, audio-visual

synchronicity is the first step, but organisations must also consider how information, procedures, work-place culture, colleague support-systems and knowledge-transfer integrate across the different hyflex environments. Further investigation into the affordances and implications of manipulatable communication “objects” is also important. Both these key considerations would be especially important to inform future policies and best-practices.

References

Alquraini, T., & Dianne Gut, D. (2012). Critical Components of Successful Inclusion of Students with Severe Disabilities: Literature Review. International Journal of Special Education, 27, 42-59.

De Boer, A., Pijl, S. J., & Minnaert, A., (2011) Regular primary school teachers' attitudes towards inclusive education: a review of the literature, International Journal of Inclusive Education, 15:3, 331- 353, DOI: 10.1080/13603110903030089

Anderson, C. J. K., Klassen, R. M., & Georgiou, G. K. (2007). Inclusion in Australia: What Teachers Say They Need and What School Psychologists Can Offer. School Psychology International, 28(2), 131-147. https://doi.org/10.1177/0143034307078086

Barter, D., Crasto, T., Lee, E., Ingino, R. A, & Coppin, P. (2022). Fostering shared intentionality for diverse learners through cross-sensory interaction design. *Proceedings of the Annual Meeting of the Cognitive Science Society*, 44. Retrieved from https://escholarship.org/uc/item/37h3r438

Barker, R.G. (1968). Ecological Psychology: Concepts and Methods for Studying the Environment of Human Behavior; Stanford University Press: Palo Alto, CA, USA,

Basham, J. D., Meyer, H., & Perry, E., (2010) The Design and Application of the Digital Backpack, Journal of Research on Technology in Education, 42:4, 339-359, DOI: 10.1080/15391523.2010.10782555

Beatty, B. (2006, October). Designing the HyFlex World- Hybrid, Flexible Classes for All Students. Paper presented at the Association for Educational Communication and Technology International Conference, Dallas, TX.

Blanchard, A. (2004). Virtual Behavior Settings: an Application of Behavior Setting Theories to Virtual Communities, Journal of Computer-Mediated Communication, Volume 9, Issue 2, 1 January 2004, JCMC924, https://doi.org/10.1111/j.1083-6101.2004.tb00285.x

Bower, M., Kenney, J., Dalgarno, B., Lee, M. J. W., & Kennedy, G. E. (2014). Patterns and principles for blended synchronous learning: Engaging remote and face-to-face learners in rich-media real-time collaborative activities.*Australasian Journal of Educational Technology, 30*(3), 261-272.

CAST (2018a). Universal design for learning guidelines version 2.2 [graphic organizer]. Wakefield, MA: Author.

CAST (2018b). UDL and the learning brain. Wakefield, MA: Author. Retrieved from http://www.cast.org/our-work/publications/2018/udl-learning-brain-neuroscience.html

Chavez, J., (2020): Space-time in the study of learning trajectories,Learning: Research and Practice, DOI: 10.1080/23735082.2020.1811884

Clandinin, D. J., & Connelly, F. M. (2000). *Narrative inquiry: Experience and story in qualitative research*. San Francisco: Jossey-Bass. Inc.

Cowan, C. (2022, August 17). *The Art of Constructive Disengagement*. Medium. Retrieved February 23, 2023, from https://blog.holacracy.org/constructive-disengagement-623afb906efc

Delano, M. E. (2007). Video Modeling Interventions for Individuals with Autism. Remedial and Special Education, 28(1), 33–42. https://doi.org/10.1177/07419325070280010401

Detyna, M., Sanchez-Pizani, R., Giampietro, V., Dommett, E., Dyer, K. (2023). Hybrid flexible (HyFlex) teaching and learning: climbing the mountain of implementation challenges for synchronous online and face-to-face seminars during a pandemic. Learning Environ Res 26, 145–159 (2023). https://doi.org/10.1007/s10984-022-09408-y

Downing, J. E., & Peckham-Hardin, K. D. (2007). Inclusive Education: What Makes it a Good Education for Students with Moderate to Severe Disabilities? *Research and Practice for Persons with Severe Disabilities*, *32*(1), 16–30. https://doi.org/10.2511/rpsd.32.1.16

Galdas, P. (2017). Revisiting Bias in Qualitative Research: Reflections on Its Relationship With Funding and Impact. International Journal of Qualitative Methods. https://doi.org/10.1177/1609406917748992

Garton, L. & Wellman, B. (1996). Social impacts of electronic mail in organizations: A review of the research literature. Communication Yearbook, 18, 434–453.

Gibson, J.J. (1979) The Ecological Approach to Visual Perception; Houghton-Mifflin: Boston, MA, USA.

Ginley, B. (2020). Working remotely if you are visually impaired. *British Journal of Visual Impairment*. DOI: https://doi.org/10.1177%2F0264619620925702.

Hagen, P, Collin, P, Metcalf, A, Nicholas, M, Rahilly, K, & Swainston, N. (2012). Participatory Design of evidence-based online youth mental health promotion, prevention, early intervention and treatment. Young and Well Cooperative Research Centre. Retrieved from

https://www.westernsydney.edu.au/__data/assets/pdf_file/0005/476330/Young_and_Well_CRC_IM_PD_Guide.pdf

Heft, H. (2001) Ecological Psychology in Context: James Gibson, Roger Barker, and the Legacy of William James's Radical Empiricism; Lawrence Erlbaum Associates, Inc.: Mahwah, NJ, USA.

Heft, H., Hoch, J., Edmunds, T., & Weeks, J. (2014). Can the Identity of a Behavior Setting Be Perceived Through Patterns of Joint Action? An Investigation of Place Perception. Behavioral Sciences, 4(4), 371–393. MDPI AG. Retrieved from http://dx.doi.org/10.3390/bs4040371

Heesen, R., Genty, E., Rossano, F. et al. (2017). Social play as joint action: A framework to study the evolution of shared intentionality as an interactional achievement. Learn Behav 45, 390–405. https://doi.org/10.3758/s13420-017-0287-9

Hollister B, Nair P, Hill-Lindsay S and Chukoskie L (2022). Engagement in Online Learning: Student Attitudes and Behavior During COVID-19. Front. Educ. 7:851019. doi: 10.3389/feduc.2022.851019

Kahn, G. (2021, March 3). *Covid-19 has made education more accessible for university students with Mobility Disabilities*. CBC news. Retrieved March 15, 2022, from https://www.cbc.ca/news/canada/montreal/disabilities-university-pandemic-access-distance-learning-1.5932146

Khan, S., Kambris, M.E.K. & Alfalahi, H. (2022). Perspectives of University Students and Faculty on remote education experiences during COVID-19- a qualitative study. Educ Inf Technol 27, 4141–4169 (2022). https://doi.org/10.1007/s10639-021-10784-w

Lee, E., Sukhai, M., & Coppin, P. (2022). How virtual work environments convey perceptual cues to foster shared intentionality during Covid-19 for blind and partially sighted employees. In *Proceedings of the Cogsci conference*(Cogsci 2022).

Lupton, E., & Lipps, A. (2017). The Senses: Design Beyond Vision. New York, US: Cooper Hewitt.

Mace, R., G. Hardie, and J. Plaice. (1991). Accessible environments: Toward universal design. In W. Preiser et al, eds. Design Interventions: Toward a More Humane Architecture. New York: Van Nostrand Reinhold.

Malnar, J. M., & Vodvarka, F. (2004). Ranges of the Senses. In Sensory Design. Minnesota, US: University of Minnesota Press.

Microsoft. (2023a, March 28). *Avatars for Microsoft teams*. Microsoft 365 insider . Retrieved from https://insider.microsoft365.com/en-us/blog/avatars-for-microsoft-teams

Microsoft. (2023b). *Microsoft MakeCode Computer Science Education*. Microsoft MakeCode. Retrieved from https://www.microsoft.com/en-us/makecode

Moore, G. (1986). Effects of Spatial Definition on Behavior Settings on Children's Behavior: A Quasi-Experimental Field Study . Journal of Environmental Psychology, 6(1986), 205–231.

Moya, L. J., and Tolk, A. (2007). Towards a Taxonomy of Agents and Multi-agent Systems. In Proceedings of the 2007 Spring Simulation Multi-Conference-Volume 2, 11–18. Society for Computer Simulation International, San Diego CA, 2007.

Nakalowa, M., & Salawat, N. (2019, December 29). *Differentiation: Achieving success in a mixed-ability classroom*. The Science of Learning.

Neca, P. Borges, M., Pinto, P. (2022) Teachers with disabilities: a literature review, International Journal of Inclusive Education, 26:12, 1192-1210, DOI: 10.1080/13603116.2020.1776779

Oliver, M. (1990). The Politics of Disablement. London. Macmillan Education.

OWL labs. (2022). *Meeting Owl® 3*. Meeting Owl 3 - 360-Degree, 1080p HD Smart Video Conference Camera, Microphone, and Speaker (Automatic Speaker Focus & Smart Zooming and Noise Equalizing). Retrieved from https://owllabs.ca/products/meeting-owl-3/

Pichette, J., Brumwell, S., & Rizk, J. (2020). *Improving the accessibility of remote higher education: Lessons from the pandemic and recommendations*. Higher Education Quality Council of Ontario.

Reese, S. A. (2015). Online learning environments in higher education: Connectivism vs. dissociation. Education and Information Technologies, 20(3), 579–588. https://doi.org/10.1007/s10639-013-9303-7

Rose, D.H., and Meyer, A. (2002). *Teaching every student in the digital age: Universal Design for Learning.* Alexandria, VA: Association for Supervision and Curriculum Development.

Simon, H. A. (1991). Bounded Rationality and Organizational Learning. *Organization Science*, *2*(1), 125–134. http://www.jstor.org/stable/2634943

Simon, H. A. (2019). The Sciences of the Artificial, reissue of the third edition with a new introduction by John Laird. MIT press.

Spinuzzi, C. (2005). The Methodology of Participatory Design. Technical Communication, 52(2), 163–174.

St. Amour, M. (2020, May 13). How neurodivergent students are getting through the pandemic. Inside Higher Ed. Retrieved October 17, 2021 from https://www.insidehighered.com/news/2020/05/13/neurodivergent-students-face-challenges-quick-switch-remote-learning

Sweller, J., Ayres, P., Kalyuga, S. (2011). Intrinsic and Extraneous Cognitive Load. In: Cognitive Load Theory. Explorations in the Learning Sciences, Instructional Systems and Performance Technologies, vol 1. Springer, New York, NY. https://doi.org/10.1007/978-1-4419-8126-4_5

Szasz, T. S. (1960). The myth of mental illness. American Psychologist, 15(2), 113–118. https://doi.org/10.1037/h0046535

Thurston, T. N., Lundstrom, K., & González, C. (Eds.) (2021). Resilient pedagogy: Practical teaching strategies to overcome distance, disruption, and distraction. Utah State University. https://doi.org/ 10.26079/a516-fb24

Tomasello, M., Carpenter, M., Call, J., Behne, T., & Moll, H. (2005). Understanding and sharing intentions: the origins of cultural cognition. The behavioral and brain sciences. DOI: https://doi.org/10.1017/S0140525X05000129.

UNESCO. (2020). Global Education Monitoring Report 2020: Inclusion and education: All means all. Paris, UNESCO

Ware, H., Singal, N., & Groce, N., (2021) The work lives of disabled teachers: revisiting inclusive education in English schools, Disability & Society, DOI: 10.1080/09687599.2020.1867074

Weick, K. E., (1979). The social psychology of organizing (2nd Edition). New York: Random House.

Wicker, A. W. (1979). An introduction to ecological psychology. Monterey, CA: Brooks Cole Publishing

Wicker, A. W. (1987). Behavior settings reconsidered: Temporal stages, resources, internal dynamics, context. In D. Stokols & I. Altman (Eds.), Handbook of environmental psychology (Vol. 1, pp. 613–654). New York: Wiley.

Appendix A: Survey

Hello! Thank you for your interest in the workshop, *Fostering shared intentionality for diverse learners through cross-sensory interaction design*. This voluntary survey will help us tailor our workshop activities and arrange groups for the activities at CogSci 2022. We'd appreciate your response and look forward to your attendance!

Survey responses will be confidential. Only the workshop organizers will have access to this information.

Start press Enter ↵

Takes X minutes

1→ What is your name? *

If you are not comfortable sharing your first name, please use a nickname or pseudonym you will remember. This information will be used to pre-arrange groups for workshop activities.

Type your answer here...

OK ✓

2 → x, please list your areas of expertise.

This could be professional expertise, skills, hobbies, or areas of interest

Type your answer here...

Shift ⇧ + Enter ↵ to make a line break

OK ✓

3 → We aim to provide an inclusive, accessible workshop that enables all individuals, including individuals with disabilities, to fully engage. Please let us know if you require any accessibility accommodations for this workshop (e.g. screen reader compatibility).

Your response will help us tailor the format of the activity.

Type your answer here...

OK ✓

Questions 4 - 6 are examples of questions that we will work through in the workshop. The aim of these questions is to provide us with some initial information to structure our workshop.

Continue press Enter ↵

4 → Could you please describe your experience of any issues regarding access to Information and Communication Technologies (ICTs) during the pandemic (e.g. issues with video conferencing platforms).

These could include first hand or second hand accounts of accessibility issues (e.g. understanding that blind and partially sighted individuals were not able to access content shared via share screen in a video conference).

Type your answer here...

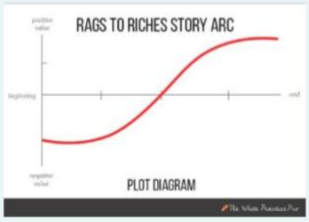
Shift ⇧ + Enter ↵ to make a line break

OK ✓

5 → Could you please think of challenges/benefits you experienced using ICTs during the pandemic? Next, choose a story arc structure (or combination of structures) that best outlines your journey with these challenges/benefits.

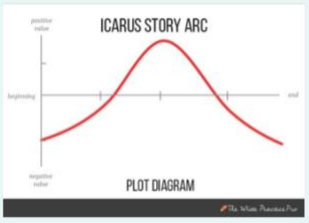
For an explanation of each story arc, visit https://thewritepractice.com/story-arcs

Choose as many as you like



A Rags-to-riches

B Riches-to-rags



C Freytag/Icarus

D Man-in-a-hole

E Double-man-in-a-hole

F Oedipus

G Cinderella

OK ✓

6 → In 5 to 9 points (depending on your chosen story arc), please describe your journey with first or second-hand accounts of challenges/benefits of ICTs during the pandemic.

Type your answer here...

Shift ⇧ + Enter ↵ to make a line break

Submit

Appendix B: Retrospective Narrative Inquiry Guide

Objective: Establish participants' lived experiences of challenges and benefits of remote ICTs in learning environments during the pandemic

Room Set-Up: 3 groups with 7-10 people each (if pre-grouped, place list of participants on each table); 1 facilitator per group; 1 foam core board per table; Pens and post-its (3 colours)

Online set-up: 5 groups with 8-10 people each; 1 facilitator and shadow facilitator per group; Use google sheet template; facilitator to screen and audio record break-out room

In-person facilitators: _____

Virtual facilitators: _____

5 minutes (Introduction; Transition to groups)

Facilitator: *We'll be moving into smaller groups for this activity. Each group will be reflecting on their lived experiences during a specific phase of the pandemic (remote learning/working), and then examining the role of ICTs in their experiences.*

By "ICTs", we're referring to any information and communication technologies you use(d) for personal or professional reasons, like Zoom, Teams, WhatsApp, Office 365, Google Suite, etc.

Each group will have 1 facilitator to help guide you, or answer any questions you may have. In 30 minutes, we'll come back together and 1 person from each group will share key points and insights from your discussion.

30 minutes (Conducting the activity)

Overview: Groups split up to cover different "phases" of the pandemic; the switch, storming, and post-storming. Each "phase" will have an online and in-person group.

PHASE 1 - The Switch
- Online (Breakout group 1; Facilitators: _____)
- In person (Group 1; Facilitators: _____)

PHASE 2 - Storming
- Online (Breakout group 2 - Facilitators: _____; Group 3-Facilitators: _____)
- In person (Group 2; Facilitators: _____)

PHASE 3- Post-storming
- Online (Breakout group 4-Facilitators: _____; Group 5-Facilitators: _____)
- In person (Group 3; Facilitators: _____)

PHASE 1 - The Switch
Online (Breakout group 1; Facilitators: _____)

Facilitator: Hi everyone, my name is _____. It's nice to have everyone here. Let's do a quick round of introductions while I set up my screen share.

[Facilitator to screen-share template]

[Shadow facilitator to start screen/audio recording and share this message in the chat: Hello, we'll be using this document _____ for our activity. Please open the link and check that you have editing access to type your responses]

Facilitator: Great! Now that we know everyone's names and are all set-up, let get started! Our group is focusing on the beginning phase of the pandemic, so try and think back to your first day of lockdown or when the switch to remote learning or work happened for you.

Before we start typing, let's share out loud some of the first things that come to mind when you think back to the very start of your remote learning/working experience.

[Facilitator to create space for responses and engage with participants. Up to 3 minutes]

[Shadow facilitator to privately inform facilitator at the 3 minute mark]

Facilitator: Thank you for sharing. Let's switch over to our shared document now and take 10-12 minutes to describe your experience of that phase.

What were some of the positive aspects that you remember?

What was challenging?

Additional guiding questions:

What kinds of changes to the learning environment(s) occurred immediately once the pandemic started? Why?

Describe some of the challenges and / or benefits for the learning environment(s) that resulted from the sudden shift.

How much virtual participation in virtual learning/working environments occurred at this time in your experience? Why do you think that was?

[Facilitator to review written responses, ask follow up questions* and document key patterns/insights on the google sheet. Up to 12 minutes]
[Shadow facilitator to privately inform facilitator at the 10 minute mark]

*Look for comments that may indicate an underlying issue (often people will write about feelings; try to uncover what factors cause that feeling), a change in relationship with peers (and the cause), and mismatches between the ICT's and them.

Sample follow-up questions:

- I notice that you mention _____. Could you expand on that?

- ____, you indicate that there was an increase of remote communication between you and your co-workers. Why was that? What did the process of communication look like?
- Why do you think _____ was so challenging/positive?

Facilitator: Thank you for your openness and sharing your experiences, its so interesting to see the commonalities in our experiences across contexts, but also the uniqueness of each. I can already see the influence of ICTs in most of your experience descriptions!

Let's take the next the next 10-12 minutes and try to explicitly outline the role of ICTs during your experience of the initial phase of the pandemic.

- *What particular platforms were you using at the time?*
- *Did these play a role in the positive or challenging aspects you described earlier?*
- *How did these ICTs inhibit/foster shared intentionality?*

[Facilitator to review written responses, ask follow up questions and document key patterns/insights on the google sheet. Up to 12 minutes]

[Shadow facilitator to privately inform facilitator at the 10 minute mark and at the 12 minute mark]

Facilitator: We have a couple of minutes left before we join the larger group to report back. Let's wrap up on the written document and discuss what stood out to you from the shared experiences and discussion.

[Facilitator to create space for responses and engage with participants; decide on who will be sharing during the reporting back phase. Up to 3 minutes]
[Shadow facilitator to privately inform facilitator when there's 1 minute of the break-out room time left]

Facilitator: Thank you all for your engagement with this activity! See you all in the main meeting room.

In-person (In-person group 1; Facilitators: _____)

Follow the guide above, but with physical materials such as post-its.

PHASE 2 - Storming

Online (Breakout group 2; Facilitators: _____)

Facilitator: Hi everyone, my name is _____. It's nice to have everyone here. Let's do a quick round of introductions while I set up my screen share.

[Facilitator to screen-share template]

[Shadow facilitator to start screen/audio recording and share this message in the chat: Hello, we'll be using this document _____ for our activity. Please open the link and check that you have editing access to type your responses]

Facilitator: Great! Now that we know everyone's names and are all set-up, let get *started! Our group is focusing on the "storming" phase of the pandemic. By the "storming" phase, we're referring to the phase of remote work/learning where things were still messy, people were trying to figure out how to work together remotely and establish effective workflows.*
Approximately around 2-4 months after the first lockdown was announced.

Before we start typing, let's share out loud some of the first things that come to mind when you think back to this phase.

[Facilitator to create space for responses and engage with participants. Up to 3 minutes]

[Shadow facilitator to privately inform facilitator at the 3 minute mark]

Facilitator: Thank you for sharing. Let's switch over to our shared document now and take 10-12 minutes to describe your experience of that phase.

What were some of the positive aspects that you remember?

What was challenging?

Additional guiding questions:

What challenges for inclusion in the remote environment(s) were most prominent, in your experience, at this stage?

What adaptations, if any, emerged to facilitate inclusion in the remote environment(s)?

[Facilitator to review written responses, ask follow up questions* and document key patterns/insights on the google sheet. Up to 12 minutes]
[Shadow facilitator to privately inform facilitator at the 10 minute mark]

*Look for comments that may indicate an underlying issue (often people will write about feelings; try to uncover what factors cause that feeling), a change in relationship with peers (and the cause), and mismatches between the ICT's and them.

Sample follow-up questions:

- I notice that you mention _____. Could you expand on that?
- ____, you indicate that ___. Why was that? What did the process look like?
- Why do you think _____ was so challenging/positive?

Facilitator: Thank you for your openness and sharing your experiences, its so interesting to see the commonalities in our experiences across contexts, but also the

uniqueness of each. I can already see the influence of ICTs in most of your experience descriptions!

Let's take the next 10-12 minutes and try to explicitly outline the role of ICTs during your experience of the "storming" phase of the pandemic.

- *What particular platforms were you using at the time?*
- *Did these play a role in the positive or challenging aspects you described earlier?*
- *How did these ICTs inhibit/foster shared intentionality?*

[Facilitator to review written responses, ask follow up questions and document key patterns/insights on the google sheet. Up to 12 minutes]

[Shadow facilitator to privately inform facilitator at the 10 minute mark and at the 12 minute mark]

Facilitator: We have a couple of minutes left before we join the larger group to report back. Let's wrap up on the written document and discuss what stood out to you from the shared experiences and discussion.

[Facilitator to create space for responses and engage with participants; decide on who will be sharing during the reporting back phase. Up to 3 minutes]
[Shadow facilitator to privately inform facilitator when there's 1 minute of the break-out room time left]

Facilitator: Thank you all for your engagement with this activity! See you all in the main meeting room.

In-person (In-person group 2; Facilitators: _____)

Follow the guide above, but with physical materials such as post-its.

PHASE 3 - Post storming
Online (Breakout group 4 and 5; Facilitators: _____)

Facilitator: Hi everyone, my name is _____. It's nice to have everyone here. Let's do a quick round of introductions while I set up my screen share.

[Facilitator to screen-share template]

[Shadow facilitator to start screen/audio recording and share this message in the chat: Hello, we'll be using this document _____ for our activity. Please open the link and check that you have editing access to type your responses]

Facilitator: Great! Now that we know everyone's names and are all set-up, let's get started! Our group is focusing on the "post-storming" phase of the pandemic. By the "post-storming" phase, we're referring to the phase of remote work/learning where things started to feel more settled in our "new normal"; people established methods of communications and (effective) remote workflows.

Approximately around 6-8 months after the first lockdown was announced.

Before we start typing, let's share out loud some of the first things that come to mind when you think back to this phase.

[Facilitator to create space for responses and engage with participants. Up to 3 minutes]

[Shadow facilitator to privately inform facilitator at the 3 minute mark]

Facilitator: Thank you for sharing. Let's switch over to our shared document now and take 10-12 minutes to describe your experience of that phase.

What were some of the positive aspects that you remember?

What was challenging?

Additional guiding questions:

When did the "storming" phase recede for you? How was the experience different from the beginning of the lockdown?

What challenges to inclusion in the remote environment(s) persisted after pandemic "normal" set in?

What adaptations, if any, emerged to facilitate inclusion in the remote environment(s)?

[Facilitator to review written responses, ask follow up questions* and document key patterns/insights on the google sheet. Up to 12 minutes]

[Shadow facilitator to privately inform facilitator at the 10 minute mark]

*Look for comments that may indicate an underlying issue (often people will write about feelings; try to uncover what factors cause that feeling), a change in relationship with peers (and the cause), and mismatches between the ICT's and them.

Sample follow-up questions:

- I notice that you mention _____. Could you expand on that?
- ____, you indicate that ___. Why was that? What did the process look like?
- Why do you think _____ was so challenging/positive?

Facilitator: Thank you for your openness and sharing your experiences, its so interesting to see the commonalities in our experiences across contexts, but also the uniqueness of each. I can already see the influence of ICTs in most of your experience descriptions!

Let's take the next 10-12 minutes and try to explicitly outline the role of ICTs during your experience of the "post storming" phase of the pandemic.

- *What particular platforms were you using at the time?*

- *Did these play a role in the positive or challenging aspects you described earlier?*
- *How did these ICTs inhibit/foster shared intentionality?*

Additional guiding questions:

What kinds of changes to ICTs/learning environment(s) do you believe is/are necessary to make going forward, as a result of this?

What issues, events or available technologies most set the stage for establishing what would be "normal" after this point?

[Facilitator to review written responses, ask follow up questions and document key patterns/insights on the google sheet. Up to 12 minutes]

[Shadow facilitator to privately inform facilitator at the 10 minute mark and at the 12 minute mark]

Facilitator: We have a couple of minutes left before we join the larger group to report back. Let's wrap up on the written document and discuss what stood out to you from the shared experiences and discussion.

[Facilitator to create space for responses and engage with participants; decide on who will be sharing during the reporting back phase. Up to 3 minutes]
[Shadow facilitator to privately inform facilitator when there's 1 minute of the break-out room time left]

Facilitator: Thank you all for your engagement with this activity! See you all in the main meeting room.

In-person (In-person group 3; Facilitators: _____)

Follow the guide above, but with physical materials such as post-its.

	A	B
1		*insert participant name*
2	**Describe your experience of the switch to remote learning or work (1st day of lockdown).** What were some strengths and challenges?	
3	**Describe the role of ICT's during this phase.** What platforms were/are used? Do/did they inhibit/foster shared intentionality?	
4	**Describe your experience of the "storming" phase (month 2-4 of lockdown).** What were some strengths and challenges?	
5	**Describe the role of ICT's during this phase.** What platforms were used? Did they inhibit/foster shared intentionality?	
6	**Describe your experience of the "post storming" phase (month 6/8-now of pandemic).** What were/are some strengths and challenges?	
7	**Describe the role of ICT's during this phase.** What platforms were/are used? Do/did they inhibit/foster shared intentionality?	
8		
9	**Facilitator's notes**	
10		

Figure 36: Digital template to document retrospective narrative inquiry activity.

Activity 1: Reporting Back

20 minutes

Objective: Share, document and further discuss observations & insights from the retrospective ethnography session with the larger group and facilitators; bridge online and in-person attendees; allow for cross-pollination of ideas

Room Set-Up: Full group together; screen-sharing online being projected on room screen; Tamara noting down shared insights on Google sheet.

In-person facilitator: _____

Virtual facilitator: _____

[in-person: projected, online: screen share and comments from the chat. Primary facilitator to add to Google Sheet]

Facilitator: It's good to have everyone back together! Each group's spokesperson will share key points and insights from their reflection and discussion in the order displayed on the left of the screen.

Appendix C: Interview Guide for Diverse Instructors

Objectives:

- Examine the strengths and limitations diverse instructors face, fostering SI in virtual environments.
- Understand which aspects of the Virtual Learning Environment (VLE) (e.g., digital environment, course materials, curriculum) fostered Shared Intentionality (SI)
- Gain insights of the perceived effect of diverse instructors on students' experiences

Thank you for agreeing to participate! While there are a couple of objectives I'd like to keep in mind, this interview will be more like a conversation.

I'm interested in hearing about your experience teaching and working in an educationl institution.

❗Reminders

1. Your participation is completely optional
2. Withdraw at any time (stop participating and/or withdraw data)
3. Information from this session will be kept confidential and be stored in a password protected folder (I will be stripping any identifiable info from the notes & transcript and will not discuss any information shared today in class settings)
4. If I use any language/terms that you would prefer an alternate to, please let me know

Questions for instructors:

- *Background*
    - Age:
    - Pronouns/gender identity:
    - Diverse characteristic/disability:
    - Years teaching:
    - Level and subject:
    - In person/virtual/hybrid:
- *Examine the strengths and limitations diverse instructors face, fostering SI in virtual/physical environments.*
    - Could you tell me what you remember from your first few experiences of teaching?
        - What has changed since then? How did this change come about?
    - Day in the life/routine?
    - Environment
        - Challenges
        - Strengths

    - SI with students
        - Challenges
        - Strengths
    - SI with colleagues
        - Challenges
        - Strengths
    - Institutional
        - Challenges
        - Strengths
- *Understand which aspects of the Virtual Learning Environment (VLE) (e.g., digital environment, course materials, curriculum) fostered Shared Intentionality (SI).*
    - What aspects of the virtual learning environment were beneficial to your teaching and understanding of your students?
        - How the ICT shape your teaching strategies/methods?
        - How did these platforms aid or inhibit collaboration/communication with your students and colleagues?
    - Were there other aspects of the tools and materials that were beneficial/challenging for you?
        - Did you develop any strategies to overcome the challenges [reiterate some challenges faced if participant struggles to recall]?
        - How did these benefits or challenges inform your curriculum design and/or selection of course materials?
    - Were there aspects of the course material/curriculum that you tailored for the virtual environment?
        - Do you see these adaptations being relevant in your future work?
    - Are there any other experiences that come to mind when you reflect on your virtual teaching and working experiences?
- *Gain insights of the perceived effect of diverse instructors on students' experiences*.
    - Do you believe that your diversity has had an effect on students in any way?
    - Have you seen any development in your students' thinking, behaviours and/or projects?

Concluding Script:

Thank you very much for participating today! If it's alright, I may follow up with some clarifications after processing the transcript.

Before we wrap up, I just want to remind you again that if at any point you decide you would like to withdraw your responses, please e-mail or message me, and I will remove it right away.

Please note also that in April, I may be publishing our findings in a MRP/paper. After this time, while it will always be anonymous, your response will be permanently recorded in some form. If you decide to withdraw after that time, we will be happy to

remove your responses from any further publication, but we will not be able to alter one that has already been published.

Thank you again for choosing to lend us your time today for this session, it is very much appreciated, and will go a long way to making this study a success! Have a great day!

Appendix D: Codesign Guides (Codesign Festival 2023)

Virtual Distractions and Accessibility Challenges

Description:

The objective of this session is to explore and prototype ideas for virtual environments that help reduce distractions and accessibility challenges (for example, unnecessary speech from screen readers, environmental noise, phone notifications, etc).

Participants:

- Individuals with varying degrees of sight and/or hearing
- 8 to 12 adult participants
- Activities conducted in 2 groups of 5

Facilitator Roles:

- Primary facilitators: _____
- Note-takers: _____
- Documentation (photos, audio, recordings): _____
- Floater: _____

Set-up and documentation:

- Set up prototyping materials for activity 1
- Set up audio and video recording for each activity
    - Video with OwlCam
    - Alternative “set” video from computer
    - Audio with external microphone (not OwlCam or computer mic)

- Pictures of sessions

Objectives:

1) Understand participants' current context of virtual platforms
2) Identify accessibility challenges and sources of distractions in virtual environments
3) Brainstorm and prototype solutions and innovations to improve accessibility and reduce distractions in virtual environments

Overview:

10:15-10:25 (10 min)	Introduction	**Introduction** of facilitators, concepts, session overview
10:25-10:35 (10 min)	Consent	**Consent** forms and explanation
10:35-10:40 (5 min)	BUFFER	
10:40-11:40 (**60 min)**	Activity 1	Understanding participants' current context, familiarization with prototyping (making current mental models), **identifying challenges and brainstorming**
11:40-11:50 (15 min)	BREAK	Set-up materials for activity 2
11:50-12:20 (30 min)	Activity 2 (1)	**Prototyping**
12:20-12:35(5 min)	BUFFER	
12:30-1:00 (30 min)	Activity 2 (2)	**Prototyping**
1:00-1:15 (15 min)	Discussion	**Conclusion** and discussion with participants

Table 7: Overview of activies for virtual distractions codesign

Introduction:

- Team introduction (3 minutes)
- Concepts/framework (5 minutes)

    - Social model of disability (relevant?)
    - Codesign
- Session overview (5 minutes)
    - Flow of events
    - Breaks
- Consent forms (10 minutes)
    - Verbal re-iteration of consent forms
    - Collect signed copies (if not electronically received)

Activity 1:

Objectives:

1. *Understanding participants' current context and **identifying challenges***
2. *Familiarizing participants with prototyping via a highly concrete making task (modeling current mental models of virtual platforms)*
3. ***Brainstorming** interventions (solutions) and innovations*

Facilitated discussion (with note-taker):

Part I:

- Participant introductions
- What platforms do you use and for what purposes?
- Popcorn association (to identify accessibility challenges): based on platforms and purposes participants have stated, the facilitator says a word or phrase, and the participant group each shares an opinion/experience that is relevant. Subsequent rounds can be started by participants.
    - Note-taker to fill out this table:

	P1	P2	P3	P4
Initial set-up/log-in				

Scheduling a meeting				
Joining a meeting				
Sending/receiving emails				
Chatting				
Breakout rooms				
Screen sharing				
Mitigate distractions				
Other accessibility challenges				
Opportunities				
Solutions				

Table 8: Note-taking template for codesign on virtual distractions

Part II:

- Let's talk about your experiences with computers/technology in general
- What do you find distracting in these virtual environments?
    - How have you been able to mitigate or manage this?
- Build and describe non visual representation of current interfaces **OR** build some other simple model of something relevant that comes to mind for the participant after Part I.

Part III:

- To refresh people's memory, these are the key points and limitations we discussed earlier: _____. Are there any more that come to mind?

- As we move forward, we'll be thinking about solutions to the challenges raised, as well as brainstorm some new ways of reducing distractions and accessibility challenges
- Let's start with this limitation: _____. What are some alternatives/solutions that come to mind?

Activity 2:

Objectives:

1. ***Prototyping*** *solutions and ideas*

- Participants work in small groups (2), bigger groups (4) or individually to simulate or represent their ideas/solutions. This can be done through **(choose an appropriate method/s)**:
    - Role acting
    - "Think-a-loud", paired with prompted questioning to verbally build out the design concept
    - Audio prototyping materials
    - Physical prototyping materials
- Prompts if participants are "stuck":
    - Mariana/Steve prototype-controlling mute buttons with external button (across-applications)
        - Pass it around the group
        - Let participants test it out and get an understanding of the MakeyMakey
        - They can build their own with facilitators (or if interested, sign up for future testing)
    - Opportunities for more autonomy over screen reader
    - Non visual representation of interfaces

Conclusion:

1. ***Discussion*** *with participants*
2. *Concluding remarks, thanks and information for follow-ups*
3. *Honorarium*

Cross-Sensory Collaboration & Creation Tools

Description:

Cross-sensory tools to (co)create digital content could revolutionise digital literacy, remote/hybrid work and digital engagement with the wider community. What approach would you take to making a tool that lets you build websites, applications, and shareable media? How do you work and create digital content with others, in a remote/hybrid environment? In this session we will explore and prototype these ideas.

Participants:

- Individuals with varying degrees of sight and/or hearing
- 8 to 12 adult participants (current registration: 10)
- Activities conducted in groups of 5

Facilitator Roles:

- Primary facilitator: _____
- Secondary facilitators: _____
- Note-takers: _____
- Documentation (photos, audio, recordings): _____
- Floater: _____

Set-up and documentation:

- Set up prototyping materials for activity 1
- Set up audio and video recording for each activity
    - Video with OwlCam
    - Alternative “set” video from computer
    - Audio with external microphone (not OwlCam or computer mic)
    - Pictures of sessions

Objectives:

1) Understand participants’ current context of remote collaboration tools and digital content creation workflows

2) Identify and document participants' current challenges with remote collaboration tools and digital content creation

3) Brainstorm and prototype levels of intervention and innovation to improve collaboration and digital content creation (through cross-sensory methods)

Overview:

2:00-2:10 (10 min)	Introduction	**Introduction** of facilitators, concepts, session overview
2:10-2:20 (10 min)	Consent	**Consent** forms and explanation
2:20-2:25 (5 min)	BUFFER	Transition into activity 1
2:25-3:00 (35 min)	Activity 1	Understanding **participants' current workflow** of remote collaboration and digital content creation, familiarisation with prototyping (making current mental models)
		Identifying **participants' current challenges** w/ remote collaboration and digital content creation
3:00-3:15 (15 min)	BREAK (coffee)	
3:15-3:50 (35 min)	Activity 1 (2)	Contd: Identifying **participants' current challenges** w/ remote collaboration and digital content creation
		Brainstorming interventions and (cross-sensory) innovations
3:50-4:00 (10min)	BREAK	Set-up materials for activity 3
4:00-4:50 (50 min)	Activity 2	**Prototyping** with tactile and auditory materials
4:50-5:00 (10 min)	Discussion	**Conclusion** and discussion with participants
	Honorarium	Gift card on the way out

Table 9: w of activies for virtual collaboration codesign

Introduction:

- Team introduction (3 minutes)
- Concepts/framework (5 minutes)
    - Social model of disability (how can we redesign the environment/structure to better match our varying abilities)
    - cross-sensory /multi-sensory
    - Codesign
- Session overview (5 minutes)
    - Flow of events
    - Breaks
- Consent forms (10 minutes)
    - Verbal re-iteration of consent forms
    - Collect signed copies (if not electronically received)

Activity 1:

Objectives:

1. *Understanding **participants' current workflow** of remote collaboration and digital content creation*
2. *Identifying **participants' current challenges** w/ remote collaboration and digital content creation*

Facilitated discussion (with note-taker):

- Participant introductions and:
    - Define remote collaboration (sharing ideas, media, documents and artifacts synchronously/asynchronously but mediated through ICTS) and digital content creation tools (google docs, recordings, images, keyboards, controllers?)
- User journeys; who, what, when, why, how?
    - What are some activities you do with people who are remote (e.g., calls, written documents, ideate/brainstorm, order groceries)?
        - What are you creating?
    - Who else is involved in these activities (other BPSI or sighted? Other diversity?)

    - How (process) do you do these activities? What tools do you use?
    - Why are these activities/tools important to your workflow?
- Strengths, challenges
    - What are some things you find beneficial?
    - What are some pain points/frustrations?
        - With the tools
        - With establishing shared intentionality with other people/collaborators

Activity 1(2):

Objectives:

1. *Identifying **participants' current challenges** w/ remote collaboration and digital content creation*
2. ***Brainstorming** interventions and (cross-sensory) innovations*

Facilitated discussion/activity:

- To refresh people's memory, these are the strengths and limitations we discussed before the break: _____. Are there any more that come to mind? Or are there ones you find yourself relating to?
- How would you prefer to collaborate remotely (speculative)?
    - Notetaker to document as "opportunity" in table below
- As we move forward, we'll be thinking about solutions to the challenges raised, as well as brainstorm some new ways of potentially collaborating remotely.
- Let's start with this limitation: _____. What are some alternatives/solutions that come to mind? What if you "combine, eliminate, substitute" sensory modalities to generate new methods of content creation/dissemination?

		Tactile	Audio	Other
Interventions	Limitation/pain point 1			
	Limitation/pain point 2			
Innovations	Opportunity 1			

Table 10: Notetaking template for virtual collaboration codesign

- Option: provide tactile, haptic, audio materials as prompts (or even analogous experiences/objects)

Activity 2:

Objectives:

1. ***Prototyping*** *with tactile and auditory materials*

- Participants work in small groups (2), bigger groups (4) or individually to simulate or represent their ideas/solutions. This can be done through:
    - Role acting
    - "Think-a-loud", paired with prompted questioning to verbally build out the design concept

- Prompts if participants are "stuck":
    - Alternatives to visual indicators of remote person's availability
    - Diversify feedback cues (nodding, facial reactions, icon reactions)
    - Alternatives to whiteboard/brainstorming tools like Miro etc (asynchronous collaboration with voice notes)
        - Audio "post-its" simulation with a group given a task (e.g., plan a meal).
            - First round: everyone leaves an "audio note" one at a time
            - Second round: review and sort
            - Third round: add/re-record notes to move group to a final choice
            - Fourth round: add/re-record notes to move group to a final choice
            - At the end ask participants what they think the final decision on the task is. Note whether comments are divergent or convergent

Conclusion:

Objectives:

1. ***Discussion*** *with participants*
2. *Concluding remarks, thanks and information for follow-ups*

3. Honorariums

Appendix E: Recruitment Email

Hello [Insert name],
I hope this email finds you well.

This is [Insert name] from OCAD University inviting you to participate in an online one-on-one interview regarding your experiences teaching, working or learning, as part of a research study. The study is led by _____, Principal Investigator, Faculty of Design, OCAD University, as part of a joint Accessibility Standards Canada (ASC), Canadian National Institute for the Blind (CNIB) and OCAD University project.

The purpose of the one-on-one interview is to investigate how the virtual learning environment (VLE) and the course's outcomes were made inclusive and accessible via: (i) the technologies through which your course's VLE was mediated, (ii) the tools that you instructed students in using for their course work, and (iii) the involvement of diverse individuals (DIs) who appeared as guests speakers in lectures and shared aspects of their lived experiences. Your knowledge and experience from having participated in developing the course curriculum and instructing the students in a VLE will help contribute to this study.

In this one-on-one interview, we may ask you questions about the experiences you had in developing and delivering the course curriculum virtually.

Study details and logistics:

- Duration: 1-1.5 hours
- Date: [Insert date of interview]
- Location: [Online password-protected video conference - Insert link to meeting room]

Your participation in this study is completely voluntary and you may choose to stop participating at any time. Your decision to stop participating will not affect the nature of your relationship with OCAD University or any of the members of the research team, either now, or in the future.

Possible benefits of participation may be that you find it beneficial to share your experiences from developing the course curriculum and instructing students, in order to contribute to research on developing more accessible and inclusive VLEs.

We do not foresee any risks or discomfort from your participation in the research.
If you have any questions about this study or require further information, please ask. If you have questions later about the research, you may contact the Co-Investigator, _____ , or the Principal Investigator, _____. This study has been reviewed and received ethics clearance through the Research Ethics Board at OCAD University [Insert REB approval #]. If you have any comments or concerns, please contact the Research Ethics Office through _____.

Would you be interested in sharing your ideas, knowledge and lived experience by contributing to this study?
If yes – Great! Would you be available to attend a session on [Insert date of interview/focus group] online?
If no – I understand. Thank you so much for your consideration. Have a good day.
If undecided – Could I follow-up with you in a few days? Great. Have a good day.

Appendix F: Workshop Descriptions

Cogsi 2022: Fostering Shared Intentionality for Diverse Learners Through Cross-Sensory Interaction Design

As the theme of this year's conference suggests, cognitive diversity among learners and educators is increasingly acknowledged. However, in our societies that increasingly require advanced education, training, and technical skills, the pressure to standardise learning objectives, delivery techniques and delivery tools, especially online, is high. In these situations, learners and educators of diverse cognitive phenotypes and abilities experience learning environments that are a poor match for their abilities, making effective delivery of educational content challenging.In addition to learning about our work developing cross-sensory interaction design principles, workshop participants will share lived experiences of the pandemic-induced experimentation in online learning over the past two years to co-design prototypes that address pain points identified by participants.

Codesign Festival 2023 (CNIB, OntarioTech University, OCAD University):Virtual Distractions and Accessibility Challenges

The objective of this session is to explore and prototype ideas for virtual environments that help reduce distractions and accessibility challenges (for example, unnecessary speech from screen readers, environmental noise, phone notifications, etc).

Codesign Festival 2023 (CNIB, OntarioTech University, OCAD University):Cross-Sensory Collaboration & Creation Tools

Cross-sensory tools to (co)create digital content could revolutionize digital literacy, remote/hybrid work and digital engagement with the wider community. What approach would you take to making a tool that lets you build websites, applications, and shareable media? How do you work and create digital content with others, in a remote/hybrid environment? In this session we will explore and prototype these ideas.

Appendix G: Consent Forms for Workshops and Codesign Festival

Informed Consent Form for Participants: Cogsci Workshop 5

Date: July 27th, 2022
Project Title: A Study of Accessible and Inclusive Virtual and Blended Information and Communication Technologies (ICTs) for the Federal Public Service and Federally Regulated Industries in post-COVID-19 Canada
Workshop Title: Facilitating Shared Intentionality for Diverse Learners Through Cross-Sensory Interaction Design.

Faculty Supervisor:
Co-Investigator(s):

PURPOSE
This workshop focuses on the lived experiences of learners and educators who experienced a shift to virtual learning environments delivered through information and communications technologies (ICTs). In these situations, learners and educators of diverse cognitive phenotypes and abilities, such as blind and partially sighted individuals (BPSI), and neurodivergent individuals who identify with traits of autism, dyslexia and others, experience learning environments that are a poor match for their abilities, making effective delivery of educational content challenging. However, with such vast human variation, many learners and educators are experiencing benefits as well as challenges in online settings, accelerated by the COVID-19 pandemic.

The Perceptual Artifacts Lab (PAL) at OCAD University is interested in exploring these successful deployments of inclusive learning, while simultaneously introducing some of the insights and tools that have come from projects and past experiences that may help us collaboratively move towards new, more accessible and inclusive virtual learning environments and ICTs. Thus, this workshop is aimed at an exploration of these issues through *co-design*, a participatory design methodology in which participants actively engage with researchers in a collaborative design process

Participation entails: A codesign session, 4 hours long, conducted with the other participants in this workshop. This session will take place either in-person at the Metro Toronto Convention Centre North Building, Room 104D, or use a video conferencing tool, Zoom, which will be audio/video-recorded with your permission. In this codesign session, you will be asked to choose one or more ICT platforms and / or common tasks that you use them for in a virtual learning environment and build one or more low-fidelity prototype(s) that reflect(s) your experiences with them. You will also shape the form and functions of new types of ICT platforms, in collaboration with facilitators and possibly other co-design session participants, to best match your or others' needs. These ideas

will be shared among a group, by collaboratively building low to medium-fidelity prototypes with a variety of household materials and / or digital tools demonstrated by the facilitators.

POTENTIAL BENEFITS

You may find it beneficial to share your lived experience in order to contribute to research on developing accessible and inclusive ICT platforms.

POTENTIAL RISKS

We do not foresee any risks or discomfort from your participation in the research. However, digital prototyping in the codesign session may involve testing virtual reality headsets. If you have any concerns about discomfort, we would be happy to discuss the process and mitigation strategies in more detail with you. Please contact, Co-Investigator, _____.

CONFIDENTIALITY

All information you provide during the research activities will be held in confidence: unless you specifically indicate your consent, your name will not appear in any report or publication of the research (See “Attribution in study reports and publications” below). All collected data from co-design activities, recordings, consent forms, and personal information will be confidential. Your data will be safely stored on a password protected drive and only accessed by the project team. Confidentiality will be provided to the fullest extent possible by law.

Audio- or video-recording:
Co-design sessions will be videotaped and audiotaped. Any identifying information in the video recordings or transcripts will be kept confidential. Please note that participants may be referred to by name in video recordings. This will be necessary so as to connect their responses to the data collected about them.

Data collected during this study, including written records from the researcher, video/audio recordings, transcripts and any other artefacts will be kept on the OCADU OneDrive, which will be encrypted and password protected.

Data will be kept for 2 years after study completion, after which time these will be securely disposed after the project is complete. Printed notes and forms will be shredded and digital files will be securely disposed, using a secure erase application.

Access to this data will be restricted to the project team.

VOLUNTARY PARTICIPATION

Participation in this study is voluntary. If you wish, you may decline to participate in any component of the study.

Further, you may decide to withdraw from this study at any time, or request withdrawal of your data prior to data analysis and you may do so without any penalty or loss of benefits to which you are entitled. Your choice of whether or not to participate will not influence your future

relations with OCAD University, the Cognitive Science Society], or the investigators involved in the research.

To withdraw from this study, let the co-investigator know at any point during the study by contacting _____.

To withdraw your data from the study, please contact_____ via email at _____ at any point without any consequence.

PUBLICATION OF RESULTS

Results of this study may be published in the OCAD University Open Research Repository. Potential other publication venues may include professional and scholarly journals, and/or presentations to conferences and colloquia. Quotations from the workshop will be published under a pseudo-identity if used, and will not be attributed to you without your permission (See "Attribution in study reports and publications" below).

CONTACT INFORMATION AND ETHICS CLEARANCE

If you have any questions about this study or require further information, please ask. If you have questions later about the research, you may contact the Co-Investigator, _____, or the Faculty Supervisor, _____, using the contact information provided above. This study has been reviewed and received ethics clearance through the Research Ethics Board at OCAD University under application #_____.

If you have questions regarding your rights as a participant in this study please contact: Research Ethics Board c/o Office of the Vice President, Research and Innovation at _____.

AGREEMENT

I agree to participate in this study, specifically the workshop, described above. I have made this decision based on the information I have read in the Informed Consent Letter. I have had the opportunity to receive any additional details I wanted about the study and understand that I may ask questions in the future. I understand that I may withdraw this consent at any time.

Name: _____

Signature: _____ Date: _____

Audio- or video- recording

☐ I agree to be [audio-/video-recorded] for the purposes of this study. I understand how these recordings will be stored and destroyed.

_____ _____
Signature of Participant Date

Attribution in study reports and publications

☐ I agree to the attribution of my contributions to this study by name in future reports and publications produced by the outcomes of the study.

_____ _____
Signature of Participant Date

Thank you for your assistance in this project. Please keep a copy of this form for your records.

Informed Consent Form for Participants: Codesign Festival

Date: February 23rd & 24th, 2023
Project Title: A Study of Accessible and Inclusive Virtual and Blended Information and Communication Technologies (ICTs) for the Federal Public Service and Federally Regulated Industries in post-COVID-19 Canada.

Faculty Supervisor:
Co-Investigator(s):

PURPOSE

Background/problem:
This study aims to investigate and address the significant needs for accessible and inclusive delivery of virtual and blended information and communication technology (hereafter referred to as "ICTs"), such as video conferencing, for the sight loss community. For this audience, using ICT platforms in a working or learning environment brings with it many challenges and benefits in regard to accessibility. There is a clear need to develop an understanding of the constraints in ICT platforms that determine whether certain representations are appropriate choices for diverse audiences.

Objectives/challenges:

- Collaboratively translate insights from participants' lived experiences of accessibility challenges and adaptations of ICT platforms into low-to-mid-fidelity ICT platform prototypes
- Describe, discuss, and iterate on new ideas for ICT platforms with participants that meet their needs

Research questions:

1. How might we develop recommendations for ICT platforms for individuals who are neurodiverse and individuals with sensory disabilities?
2. How might we support agency of diverse ICT platform users to inform these recommendations?

Participation entails: 3 hours long, conducted with the other participants for this co-design session and facilitators with subject matter expertise. These sessions will take place either in-person at Ontario Tech University's Software & Informatics Research Centre, or through a video conferencing platform, which will be audio/video-recorded with your permission. In this codesign session, you will be asked to discuss ICT platforms and / or common tasks that you use them for, and build one or more low-fidelity prototype(s) that reflect(s) your experiences with them. Then, you will shape the form and functions of new types of ICT platforms, in collaboration with facilitators and possibly other co-design session participants, to best match your needs, and share ideas among the group

POTENTIAL BENEFITS

You may find it beneficial to share your lived experience in order to contribute to research on developing ICT platforms.

POTENTIAL RISKS

We do not foresee any risks or discomfort from your participation in the research. If you have any concerns about discomfort, we would be happy to discuss the process and mitigation strategies in more detail with you. Please contact, Co-Investigator, _____.

CONFIDENTIALITY

All information you provide during the research activities will be held in confidence, unless you specifically indicate your consent, your name will not appear in any report or publication of the research (See "**Attribution in study reports and publications**" below). All collected data from co-design activities, recordings, consent forms, and personal information will be confidential. Your data will be safely stored on a password protected drive and only accessed by the project team. Confidentiality will be provided to the fullest extent possible by law.

Audio- or video-recording:

Co-design sessions will be videotaped and audiotaped. Any identifying information in the video recordings or transcripts will be kept confidential. Please note that participants may be referred

to by name in video recordings. This will be necessary so as to connect their responses to the data collected about them.

Data collected during this study, including written records from the researcher, video/audio recordings, transcripts and any other artifacts will be kept on the OCADU OneDrive, which will be encrypted and password protected.

Data will be kept for 2 years after study completion, after which time these will be securely disposed after the project is complete. Printed notes and forms will be shredded and digital files will be securely disposed, using a secure erase application.

Access to this data will be restricted to the project team.

INCENTIVES FOR PARTICIPATION

Upon the completion of each codesign session, participants will be thanked with an electronic gift card valued at $_____. Participants will receive gift cards via either email or physical cards handed out in person at the conclusion of each session. Should participants withdraw from a codesign session prior to its completion, participants will still be entitled to receive the electronic gift card for their attendance after the co-design session has concluded.

VOLUNTARY PARTICIPATION

Participation in this study is voluntary. If you wish, you may decline to answer any questions or participate in any component of the study.

Further, you may decide to withdraw from this study at any time, or request withdrawal of your data prior to data analysis and you may do so without any penalty or loss of benefits to which you are entitled. Your choice of whether or not to participate will not influence your future relations with OCAD University, the Canadian National Institute for the Blind (CNIB), or the investigators involved in the research.

To withdraw from this study, let the co-investigator know at any point during the study by contacting ____ via email at _____.

To withdraw your data from the study, please contact _____via email at _____at any point without any consequence.

PUBLICATION OF RESULTS

Results of this study may be published in the OCAD University Open Research Repository. Potential other publication venues may include: professional and scholarly journals, and/or presentations to conferences and colloquia. Quotations from interviews or surveys will be

published under a pseudo-identity and will not be attributed to you without your permission (See "**Attribution in study reports and publications**" below).

CONTACT INFORMATION AND ETHICS CLEARANCE

If you have any questions about this study or require further information, please ask. If you have questions later about the research, you may contact the Co-Investigator, ___, or the Faculty Supervisor, ___, using the contact information provided above. This study has been reviewed and received ethics clearance through the Research Ethics Board at OCAD University [REB #: __].

If you have questions regarding your rights as a participant in this study please contact: Research Ethics Board c/o Office of the Vice President, Research and Innovation at _____.

AGREEMENT

I agree to participate in this study described above. I have made this decision based on the information I have read in the Informed Consent Letter. I have had the opportunity to receive any additional details I wanted about the study and understand that I may ask questions in the future. I understand that I may withdraw this consent at any time.

Name: _____

Signature: _____ Date: _____

Audio- or video- recording

☐ I agree to be [audio-/video-recorded] for the purposes of this study. I understand how these recordings will be stored and destroyed.

_____ _____

Signature of Participant Date

Attribution in study reports and publications

☐ I agree to the attribution of my contributions to this study by name in future reports and publications produced by the outcomes of the study.

_____ _____

Signature of Participant Date

Thank you for your assistance in this project. Please keep a copy of this form for your records.

Appendix H: Consent Forms for Instructor Interviews and Codesigns

Narrative Inquiry / Semi-Structured Interviews

Date: [Insert date of interview]
Project Title: Features of virtual learning environments that increase shared intentionality for diverse learners and educators

Faculty Supervisor:

RA & Co-Investigator:

Co-Investigator:

Student Investigator:

PURPOSE

Background/problem:

This study aims to investigate how to foster “shared intentionality”, the capacity to participate in collaborative activities with shared goals and intentions, among diverse learners and educators interacting through virtual learning environments (VLEs) to increase inclusivity and accessibility. Learning and educating in a VLE brings with it many challenges and benefits in regards to accessibility. There is a clear need to develop an understanding of the properties of VLEs and how these shape the potential success or lack of success of learning outcomes when factoring in the diverse accessibility needs of learners and educators who must understand the intended meanings, or how to communicate and interpret them, of curriculum materials and their peers.

Objectives/challenges:

- Understand how the VLE, course materials, curriculum, and tools fostered shared intentionality, for/with diverse students and educators.
- Examine the strengths and limitations diverse instructors face, fostering SI in VLEs.

WHAT’S INVOLVED

Participation entails: 1 - 1.5 hour one-on-one interview online, using Online password-protected video conferencing, which will be audio/video-recorded with your permission.

POTENTIAL BENEFITS

You may find it beneficial to share your knowledge, skill development, and / or design considerations in order to contribute to research on developing inclusive and accessible VLEs.

POTENTIAL RISKS

This is a low-risk study, but if you are/were a student in Professor _____ 's courses, participation may be influenced due to an existing relationship with the instructor who is part of the project team. To address this, please note that:

(1) Participation in this study is voluntary

(2) Participation will not affect your relationship with your university or the instructor

(3) Past and (potential) future grades will not be affected

Points (2) and (3) will be ensured by the student investigator, who will assign participants a unique code, and strip any identifiers from collected data. The collected data will be stored using this code and the file containing identifiers will be destroyed at the end of the study. Therefore, the instructor will not have access to ANY identifiable data, ensuring that students' grades will not be impacted.

If you are not a past or present student in Professor _____'s courses, we do not foresee any potential risks or harm.

CONFIDENTIALITY

All information you provide during the research activities will be held in confidence. All collected data from co-design activities, recordings, consent forms, and personal information will be confidential. Your data will be safely stored on a password protected drive and only accessed by the project team. Confidentiality will be provided to the fullest extent possible by law.

Additionally, participants will be assigned a unique code, and collected data will be stripped of any identifiers. The collected data will be stored using this code and the file containing identifiers will be destroyed at the end of the study. Only the student investigator on the project team will have access to the raw data in order to code and strip the data.

Audio- or video-recording:

Interviews will be videotaped and audiotaped. When applicable, any identifying information in the video recordings or transcripts will be kept confidential. Please note

that participants may be referred to by name in video recordings. This will be necessary so as to connect their responses to the data collected about them.

Data collected during this study, including written records from the researcher, video/audio recordings, transcripts and any other artefacts will be kept on the OCADU OneDrive, which will be encrypted and password protected.

Data will be kept for 2 years after study completion, after which time these will be securely disposed after the project is complete. Printed notes and forms will be shredded and digital files will be securely disposed, using a secure erase application.

These recordings would be considered raw data, and therefore access to this data will be restricted to the Student Investigator on the project team responsible for stripping identifiers.

INCENTIVES FOR PARTICIPATION

Upon the completion of each interview, participants will be thanked with an electronic gift card of their choice, valued at $___. Participants will receive gift cards via email. Should participants withdraw from a session prior to its completion, participants will receive the electronic gift card for their attendance prior to their withdrawal.

VOLUNTARY PARTICIPATION

Participation in this study is voluntary. If you wish, you may decline to answer any questions or participate in any component of the study.

Further, you may decide to withdraw from this study at any time, or request withdrawal of your data before April 15th 2023, without any penalty. Your choice of whether or not to participate

will not influence your future relations with OCAD University or the investigators involved in the research.

To withdraw from this study, let the Student Investigator know at any point during the study by contacting _____. To withdraw your data from the study, please contact_____before April 15th 2023, without any consequence.

PUBLICATION OF RESULTS

Results of this study may be published in the OCAD University Open Research Repository. Potential other publication venues may include: professional and scholarly journals, and/or presentations to conferences and colloquia. Quotations from interviews or surveys will be published under a pseudonym (e.g., P1 for participant 1, P2 for participant 2) and will not be attributed to you.

CONTACT INFORMATION AND ETHICS CLEARANCE

If you have any questions about this study or require further information, please ask. If you have questions later about the research, you may contact the Student

Investigator,_____, or the Faculty Supervisor,_____ , using the contact information provided above. This study has been reviewed and received ethics clearance through the Research Ethics Board at OCAD University [REB #: _____].

If you have questions regarding your rights as a participant in this study please contact: Research Ethics Board c/o Office of the Vice President, Research and Innovation

AGREEMENT

I agree to participate in this study described above. I have made this decision based on the information I have read in the Informed Consent Letter. I have had the opportunity to receive any additional details I wanted about the study and understand that I may ask questions in the future. I understand that I may withdraw this consent at any time.

Name: _____

Signature: _____ Date: _____

Audio- or video- recording

☐ I agree to be [audio-/video-recorded] for the purposes of this study. I understand how these recordings will be stored and destroyed.

_____ _____

Signature of Participant Date

Thank you for your assistance in this project. Please keep a copy of this form for your records.

Co-design Sessions

Date: [Insert date]
Project Title: Features of virtual learning environments that increase shared intentionality for diverse learners and educators

Faculty Supervisor:

RA & Co-Investigator:

Co-Investigator:

Student Investigator:

PURPOSE

Background/problem:

This study aims to investigate how to foster “shared intentionality”, the capacity to participate in collaborative activities with shared goals and intentions, among diverse learners and educators interacting through virtual learning environments (VLEs) to increase inclusivity and accessibility. Learning and educating in a VLE brings with it many challenges and benefits in regards to accessibility. There is a clear need to develop an understanding of the properties of VLEs and how these shape the potential success or lack of success of learning outcomes when factoring in the diverse accessibility needs of learners and educators who must understand the intended meanings, or how to communicate and interpret them, of curriculum materials and their peers.

Objectives/challenges:

- Collaboratively build low-fidelity prototypes of participants’ representations of virtual learning environments (VLEs) in preferred materials
- Collaboratively translate insights from participants’ lived experiences of accessibility challenges and adaptations made with VLEs into medium-to-high-fidelity VLE prototypes and / or tool (e.g., microcontrollers or other physical and digital media that facilitate educational goals) / material (e.g., clay, paper, pipe cleaners) (hereafter referred to as“TM”) prototypes
- Describe, discuss, and iterate on new ideas for VLEs, materials and tools with participants that address challenges that they have experienced themselves or others that they have collaborated with in this setting.

WHAT’S INVOLVED

Participation entails a 4 hour long session, conducted with the other participants for this workshop and the workshop facilitators. These sessions will take place in-person or via Zoom, both of which will be audio/video-recorded with your permission. In this codesign session, you will first be asked to choose one or more TM and / or VLE and / or common tasks that you use them for, and build one or more low-fidelity prototype(s) that reflect(s) your experiences with them. After this, you will be asked to shape the form and functions of new types of TMs and / or VLEs, in collaboration with facilitators and possibly other co-design session participants, to best match the accessibility needs you have identified and share ideas among the group, by collaboratively building medium to high-fidelity prototypes with a variety of digital tools that you will be introduced to by the facilitators.

POTENTIAL BENEFITS

You may find it beneficial to share your knowledge, skill development, and / or design considerations in order to contribute to research on developing inclusive and accessible VLEs.

POTENTIAL RISKS

This is a low-risk study, but if you are/were a student in Professor _____ ‘s courses, participation may be influenced due to an existing relationship with the instructor who is part of the project team. To address this, please note that:

(1) Participation in this study is voluntary

(2) Participation will not affect your relationship with your university or the instructor

(3) Past and (potential) future grades will not be affected

Points (2) and (3) will be ensured by the student investigator, who will assign participants a unique code, and strip any identifiers from collected data. The collected data will be stored using this code and the file containing identifiers will be destroyed at the end of the study. Therefore, the instructor will not have access to ANY identifiable data, ensuring that students’ grades will not be impacted.

If you are not a past or present student in Professor _____’s courses, we do not foresee any potential risks or harm.

CONFIDENTIALITY

All information you provide during the research activities will be held in confidence. All collected data from co-design activities, recordings, consent forms, and personal information will be confidential. Your data will be safely stored on a password protected drive and only accessed by the project team. Confidentiality will be provided to the fullest extent possible by law.

Additionally, participants will be assigned a unique code, and collected data will be stripped of any identifiers. The collected data will be stored using this code and the file containing identifiers will be destroyed at the end of the study. Only the student investigator on the project team will have access to the raw data in order to code and strip the data.

Audio- or video-recording:

Codesign sessions will be videotaped and audiotaped. When applicable, any identifying information in the video recordings or transcripts will be kept confidential. Please note that participants may be referred to by name in video recordings. This will be necessary so as to connect their responses to the data collected about them.

Data collected during this study, including written records from the researcher, video/audio recordings, transcripts and any other artefacts will be kept on the OCADU OneDrive, which will be encrypted and password protected.

Data will be kept for 2 years after study completion, after which time these will be securely disposed after the project is complete. Printed notes and forms will be shredded and digital files will be securely disposed, using a secure erase application.

These recordings would be considered raw data, and therefore access to this data will be restricted to the Student Investigator on the project team responsible for stripping identifiers.

INCENTIVES FOR PARTICIPATION

Upon the completion of each interview, participants will be thanked with an electronic gift card of their choice, valued at $___. Participants will receive gift cards via email. Should participants withdraw from a session prior to its completion, participants will receive the electronic gift card for their attendance prior to their withdrawal.

VOLUNTARY PARTICIPATION

Participation in this study is voluntary. If you wish, you may decline to answer any questions or participate in any component of the study.

Further, you may decide to withdraw from this study at any time, or request withdrawal of your data before April 15th 2023, without any penalty. Your choice of whether or not to participate

will not influence your future relations with OCAD University or the investigators involved in the research.

To withdraw from this study, let the Student Investigator know at any point during the study by contacting _____. To withdraw your data from the study, please contact_____before April 15th 2023, without any consequence.

PUBLICATION OF RESULTS

Results of this study may be published in the OCAD University Open Research Repository. Potential other publication venues may include: professional and scholarly journals, and/or presentations to conferences and colloquia. Quotations from interviews or surveys will be published under a pseudonym (e.g., P1 for participant 1, P2 for participant 2) and will not be attributed to you.

CONTACT INFORMATION AND ETHICS CLEARANCE

If you have any questions about this study or require further information, please ask. If you have questions later about the research, you may contact the Student Investigator,_____, or the Faculty Supervisor,_____ , using the contact information provided above. This study has been reviewed and received ethics clearance through the Research Ethics Board at OCAD University [REB #: _____].

If you have questions regarding your rights as a participant in this study please contact: Research Ethics Board c/o Office of the Vice President, Research and Innovation

AGREEMENT

I agree to participate in this study described above. I have made this decision based on the information I have read in the Informed Consent Letter. I have had the opportunity to

receive any additional details I wanted about the study and understand that I may ask questions in the future. I understand that I may withdraw this consent at any time.

Name: _____

Signature: _____ Date: _____

Audio- or video- recording

☐ I agree to be [audio-/video-recorded] for the purposes of this study. I understand how these recordings will be stored and destroyed.

_____ _____

Signature of Participant Date

Thank you for your assistance in this project. Please keep a copy of this form for your records.

Appendix I: Consent Forms for Student Interviews and Codesigns

Narrative Inquiry / Semi-Structured Interviews

Date: [Insert date of interview]
Project Title: Features of virtual learning environments that increase shared intentionality for diverse learners and educators

Faculty Supervisor:

RA & Co-Investigator:

Co-Investigator:

Student Investigator:

PURPOSE

Background/problem:

This study aims to investigate how to foster “shared intentionality”, the capacity to participate in collaborative activities with shared goals and intentions, among diverse learners and educators interacting through virtual learning environments (VLEs) to increase inclusivity and accessibility. Learning and educating in a VLE brings with it many challenges and benefits in regards to accessibility. There is a clear need to develop an understanding of the properties of VLEs and how these shape the potential success or lack of success of learning outcomes when factoring in the diverse accessibility needs of learners and educators who must understand the intended meanings, or how to communicate and interpret them, of curriculum materials and their peers.

Objectives/challenges:

1. Examine students' projects to understand how their knowledge-skills fostered shared intentionality for/with diverse individuals.]

2. Understand experiences that contributed to students' learning, design considerations and success of their final designs, and how.

3. Understand how the VLE, course materials, curriculum, and tools fostered shared intentionality, for/with diverse students and educators.

4. Explore how knowledge and skills became more natural through shared intentionality with diverse individuals.

5. Examine the strengths and limitations diverse instructors face, fostering SI in VLEs.

WHAT'S INVOLVED

Participation entails: 1 - 1.5 hour one-on-one interview online, using Online password-protected video conferencing, which will be audio/video-recorded with your permission.

POTENTIAL BENEFITS

You may find it beneficial to share your knowledge, skill development, and / or design considerations in order to contribute to research on developing inclusive and accessible VLEs.

POTENTIAL RISKS

This is a low-risk study, but if you are/were a student in Professor _____ 's courses, participation may be influenced due to an existing relationship with the instructor who is part of the project team. To address this, please note that:

(1) Participation in this study is voluntary

(2) Participation will not affect your relationship with your university or the instructor

(3) Past and (potential) future grades will not be affected

Points (2) and (3) will be ensured by the student investigator, who will assign participants a unique code, and strip any identifiers from collected data. The collected data will be stored using this code and the file containing identifiers will be destroyed at the end of the study. Therefore, the instructor will not have access to ANY identifiable data, ensuring that students' grades will not be impacted.

If you are not a past or present student in Professor _____'s courses, we do not foresee any potential risks or harm.

CONFIDENTIALITY

All information you provide during the research activities will be held in confidence. All collected data from co-design activities, recordings, consent forms, and personal information will be confidential. Your data will be safely stored on a password protected drive and only accessed by the project team. Confidentiality will be provided to the fullest extent possible by law.

Additionally, participants will be assigned a unique code, and collected data will be stripped of any identifiers. The collected data will be stored using this code and the file

containing identifiers will be destroyed at the end of the study. Only the student investigator on the project team will have access to the raw data in order to code and strip the data.

Audio- or video-recording:

Interviews will be videotaped and audiotaped. When applicable, any identifying information in the video recordings or transcripts will be kept confidential. Please note that participants may be referred to by name in video recordings. This will be necessary so as to connect their responses to the data collected about them.

Data collected during this study, including written records from the researcher, video/audio recordings, transcripts and any other artefacts will be kept on the OCADU OneDrive, which will be encrypted and password protected.

Data will be kept for 2 years after study completion, after which time these will be securely disposed after the project is complete. Printed notes and forms will be shredded and digital files will be securely disposed, using a secure erase application.

These recordings would be considered raw data, and therefore access to this data will be restricted to the Student Investigator on the project team responsible for stripping identifiers.

INCENTIVES FOR PARTICIPATION

Upon the completion of each interview, participants will be thanked with an electronic gift card of their choice, valued at $____. Participants will receive gift cards via email. Should participants withdraw from a session prior to its completion, participants will receive the electronic gift card for their attendance prior to their withdrawal.

VOLUNTARY PARTICIPATION

Participation in this study is voluntary. If you wish, you may decline to answer any questions or participate in any component of the study.

Further, you may decide to withdraw from this study at any time, or request withdrawal of your data before April 15th 2023, without any penalty. Your choice of whether or not to participate

will not influence your future relations with OCAD University or the investigators involved in the research.

To withdraw from this study, let the Student Investigator know at any point during the study by contacting _____. To withdraw your data from the study, please contact_____before April 15th 2023, without any consequence.

PUBLICATION OF RESULTS

Results of this study may be published in the OCAD University Open Research Repository. Potential other publication venues may include: professional and scholarly

journals, and/or presentations to conferences and colloquia. Quotations from interviews or surveys will be published under a pseudonym (e.g., P1 for participant 1, P2 for participant 2) and will not be attributed to you.

CONTACT INFORMATION AND ETHICS CLEARANCE

If you have any questions about this study or require further information, please ask. If you have questions later about the research, you may contact the Student Investigator,_____, or the Faculty Supervisor,_____ , using the contact information provided above. This study has been reviewed and received ethics clearance through the Research Ethics Board at OCAD University [REB #: _____].

If you have questions regarding your rights as a participant in this study please contact: Research Ethics Board c/o Office of the Vice President, Research and Innovation

AGREEMENT

I agree to participate in this study described above. I have made this decision based on the information I have read in the Informed Consent Letter. I have had the opportunity to receive any additional details I wanted about the study and understand that I may ask questions in the future. I understand that I may withdraw this consent at any time.

Name: _____

Signature: _____ Date: _____

Audio- or video- recording

☐ I agree to be [audio-/video-recorded] for the purposes of this study. I understand how these recordings will be stored and destroyed.

_____ _____

Signature of Participant Date

Thank you for your assistance in this project. Please keep a copy of this form for your records.

Co-design Sessions

Date: [Insert date]
Project Title: Features of virtual learning environments that increase shared intentionality for diverse learners and educators

Faculty Supervisor:

RA & Co-Investigator:

Co-Investigator:

Student Investigator:

PURPOSE

Background/problem:

This study aims to investigate how to foster “shared intentionality”, the capacity to participate in collaborative activities with shared goals and intentions, among diverse learners and educators interacting through virtual learning environments (VLEs) to increase inclusivity and accessibility. Learning and educating in a VLE brings with it many challenges and benefits in regard to accessibility. There is a clear need to develop an understanding of the properties of VLEs and how these shape the potential success or lack of success of learning outcomes when factoring in the diverse accessibility needs of learners and educators who must understand the intended meanings, or how to communicate and interpret them, of curriculum materials and their peers.

Objectives/challenges:

- Collaboratively build low-fidelity prototypes of participants’ representations of virtual learning environments (VLEs) in preferred materials
- Collaboratively translate insights from participants’ lived experiences of accessibility challenges and adaptations made with VLEs into medium-to-high-fidelity VLE prototypes and / or tool (e.g., microcontrollers or other physical and digital media that facilitate educational goals) / material (e.g., clay, paper, pipe cleaners) (hereafter referred to as“TM”) prototypes
- Describe, discuss, and iterate on new ideas for VLEs, materials and tools with participants that address challenges that they have experienced themselves or others that they have collaborated with in this setting.

WHAT’S INVOLVED

Participation entails a 4 hour long session, conducted with the other participants for this workshop and the workshop facilitators. These sessions will take place in-person or via Zoom, both of which will be audio/video-recorded with your permission. In this codesign session, you will first be asked to choose one or more TM and / or VLE and / or common tasks that you use them for, and build one or more low-fidelity prototype(s) that reflect(s) your experiences with them. After this, you will be asked to shape the form and functions of new types of TMs and / or VLEs, in collaboration with facilitators and possibly other co-design session participants, to best match the accessibility needs you have identified and share ideas among the group, by collaboratively building medium to high-fidelity prototypes with a variety of digital tools that you will be introduced to by the facilitators.

POTENTIAL BENEFITS

You may find it beneficial to share your knowledge, skill development, and / or design considerations in order to contribute to research on developing inclusive and accessible VLEs.

POTENTIAL RISKS

This is a low-risk study, but if you are/were a student in Professor _____ 's courses, participation may be influenced due to an existing relationship with the instructor who is part of the project team. To address this, please note that:

(1) Participation in this study is voluntary

(2) Participation will not affect your relationship with your university or the instructor

(3) Past and (potential) future grades will not be affected

Points (2) and (3) will be ensured by the student investigator, who will assign participants a unique code, and strip any identifiers from collected data. The collected data will be stored using this code and the file containing identifiers will be destroyed at the end of the study. Therefore, the instructor will not have access to ANY identifiable data, ensuring that students' grades will not be impacted.

If you are not a past or present student in Professor _____'s courses, we do not foresee any potential risks or harm.

CONFIDENTIALITY

All information you provide during the research activities will be held in confidence. All collected data from co-design activities, recordings, consent forms, and personal information will be confidential. Your data will be safely stored on a password protected drive and only accessed by the project team. Confidentiality will be provided to the fullest extent possible by law.

Additionally, participants will be assigned a unique code, and collected data will be stripped of any identifiers. The collected data will be stored using this code and the file containing identifiers will be destroyed at the end of the study. Only the student investigator on the project team will have access to the raw data in order to code and strip the data.

Audio- or video-recording:

Codesign sessions will be videotaped and audiotaped. When applicable, any identifying information in the video recordings or transcripts will be kept confidential. Please note that participants may be referred to by name in video recordings. This will be necessary so as to connect their responses to the data collected about them.

Data collected during this study, including written records from the researcher, video/audio recordings, transcripts and any other artefacts will be kept on the OCADU OneDrive, which will be encrypted and password protected.

Data will be kept for 2 years after study completion, after which time these will be securely disposed after the project is complete. Printed notes and forms will be shredded and digital files will be securely disposed, using a secure erase application.

These recordings would be considered raw data, and therefore access to this data will be restricted to the Student Investigator on the project team responsible for stripping identifiers.

INCENTIVES FOR PARTICIPATION

Upon the completion of each interview, participants will be thanked with an electronic gift card of their choice, valued at $___. Participants will receive gift cards via email. Should participants withdraw from a session prior to its completion, participants will receive the electronic gift card for their attendance prior to their withdrawal.

VOLUNTARY PARTICIPATION

Participation in this study is voluntary. If you wish, you may decline to answer any questions or participate in any component of the study.

Further, you may decide to withdraw from this study at any time, or request withdrawal of your data before April 15th 2023, without any penalty. Your choice of whether or not to participate

will not influence your future relations with OCAD University or the investigators involved in the research.

To withdraw from this study, let the Student Investigator know at any point during the study by contacting _____. To withdraw your data from the study, please contact_____before April 15th 2023, without any consequence.

PUBLICATION OF RESULTS

Results of this study may be published in the OCAD University Open Research Repository. Potential other publication venues may include: professional and scholarly journals, and/or presentations to conferences and colloquia. Quotations from interviews or surveys will be published under a pseudonym (e.g., P1 for participant 1, P2 for participant 2) and will not be attributed to you.

CONTACT INFORMATION AND ETHICS CLEARANCE

If you have any questions about this study or require further information, please ask. If you have questions later about the research, you may contact the Student Investigator,_____, or the Faculty Supervisor,_____ , using the contact information provided above. This study has been reviewed and received ethics clearance through the Research Ethics Board at OCAD University [REB #: _____].

If you have questions regarding your rights as a participant in this study please contact: Research Ethics Board c/o Office of the Vice President, Research and Innovation

AGREEMENT

I agree to participate in this study described above. I have made this decision based on the information I have read in the Informed Consent Letter. I have had the opportunity to receive any additional details I wanted about the study and understand that I may ask questions in the future. I understand that I may withdraw this consent at any time.

Name: _____

Signature: _____ Date: _____

Audio- or video- recording

☐ I agree to be [audio-/video-recorded] for the purposes of this study. I understand how these recordings will be stored and destroyed.

_____ _____

Signature of Participant Date

Thank you for your assistance in this project. Please keep a copy of this form for your record