Geoaccessibility: Developing A Framework for Inclusive Futures

by

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Abstract

In this project, I explore how the intersection between GIS, health geographies, and feminist geographies can propel accessibility geographies forward. I argue that working at this intersection provides particularly insightful results and enhances the overall understanding of accessibility. To illustrate this concept, I partnered with a community organization, STEPS Forward, to complete three key projects that generated new visualizations of accessibility data in the context of inclusive post-secondary education in British Columbia. This work culminated into the development of a new analytical framework called "Geoaccessibility". The outcomes highlight the effectiveness and power this new Geoaccessibility framework has in identifying potential barriers to access, and areas that are excelling in being inclusive. The framework has been developed with a community focus, and aims to provide accessibility strategies by giving actionable insights and fostering inclusive practices, which I hope will be of use to others in the generation of healthy futures.

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Territorial Acknowledgements

First, I would like to acknowledge and respect the Lək̓ʷəŋən (Sc̓ianghees and Esquimalt) Peoples on whose territory the University of Victoria stands, and the Lək̓ʷəŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day. I would also like to acknowledge the traditional first nations territories throughout British Columbia whose land is visualized on many of the maps throughout this project. To learn more about these territories and lands, please use this web map from the British Columbia Assembly of First Nations: https://www.bcafn.ca/first-nations-bc/interactive-map

General Acknowledgements

I would firstly like to acknowledge and thank the prolific geographers who have come before me to allow for this paper to exist. As far back as Hippocrates, to as recent as my capstone GIS project with Dr. Chris Bone, and everyone in between, you have all allowed me to take my first step into moving geography forward as a discipline, and for that I will be forever grateful. To paraphrase Albert Einstein, I have been able to see further because of the shoulders of the giants I stand on.

I would now like to recognize the incredible efforts of my community partner, STEPS Forward, and especially Executive Director Arden Duncan-Bonokoski. With our continued conversations and progress on this project, I believe we have been able to create something powerful that can create positive change for accessibility.

Next, I would like to acknowledge my supervisor and mentor, Teresa Dawson. Thank you does not come close to cutting it for all your continued guidance throughout this project. There were times I doubted there was light at the end of this 14,000-word tunnel, however you always were there to encourage and motivate me to persevere. I am a much more capable geographer because of this experience, so for that, thank you.

Lastly, I would like to acknowledge my family for their support for not only this project but my degree overall. Thank you for always believing in me, for your insightful words of encouragement. They always came at the perfect time. Thank you for your encouragement, and for reminding me of the bigger picture. Thank you for reminding me I need to take breaks. Thanks for always having my back.

- Sam

Chapter 1: Introducing my Motivations and Commitments to Advancing Accessibility

"*The introduction of many minds into many fields of learning along a broad spectrum keeps alive questions about the accessibility, if not the unity, of knowledge."*

- Edward H. Levi (n.d)

The topic of accessibility is something that intersects with my own identity and passions. My interest in the area originally stemmed from the use of 3D printing to help those with visual impairments understand maps and complex geologic features in geography. From this idea I continued my exploration into what it means for education to be accessible, and how I can help. As someone who is quite colourblind, I have always found reading certain types of heat or colour-based maps to be quite challenging. When I was introduced to a 3D printed map, where the variable usually represented by colour was instead the height of the extrusion, I felt like I was able to have a much deeper understanding of the map and its message, and ultimately I felt like I had the same level of access as someone without colourblindness, which made a remarkable difference for my confidence in understanding the map at a glance. From this personal insight emerged a commitment to accessible geographies.

I also have a large passion for mapping and GIS. Through a various assortment of projects and classes (like those taken with Dr. Ian O'Connell and Dr. Chris Bone), I began to find a unique intersection between GIS and accessibility geographies, and specifically how I can use GIS as a powerful tool to create more accessible spaces. After having done a directed study focused on the implementation of mapping in inclusive education with Professor Teresa Dawson at the University of Victoria, and getting to know my community partner, STEPS Forward BC (bc-ipse.org), an inclusive post secondary education initiative through professor Dawson, I have already been able to see how powerful these tools can potentially be.

To further contextualize the following dissertation, it is important to explicitly define what is meant when the words "Accessibility" and "Diversity" are used. Both terms can be seen as "loaded words" that carry many different meanings depending on the reader's personal experiences among many other environmental factors. To begin, unless otherwise stated, when accessibility is referenced, I am specifically addressing accessibility in inclusive post secondary education as it relates to those who are experiencing forms of complex developmental and physical disabilities. This dissertation does also focus on the broader theme of access, and that is a cornerstone of the framework I have developed. However, accessibility has been specifically used in the community partner's definition of the word as they largely shaped the primary case study. Similar to accessibility, diversity is an extremely broad word that can be applied to gender, race, income, and a plethora of other contexts. This paper focuses on diversity in terms of the uniqueness of students supported through STEPS Forward, and how they navigate their post secondary educational experience.

Accessibility is something that is important to me as it has enabled me to overcome my barriers with colourblindness in the past. Moreover, seeing how impactful GIS can be for creating accessibility has been a very motivating journey. I am very excited to begin this new

exploration of accessibility geographies and do my part in making the world a more inclusive place.

As a short aside, I have often felt that academic papers are largely inaccessible because of the complex language and jargon they use, as well as presenting concepts at the highest possible level without always providing any context to the reader. As someone who is passionate about accessibility, this is something that has always bothered me and, given I am writing a paper about accessibility, I feel it is only right that I make a formal commitment to making this an accessible paper not written exclusively for academics. In addition, I wanted to ensure that my end result was usable to the community partner as well as other communities concerned with access nationally.

Chapter 2: Situating this Study at the Intersection of Three Geographies

Models of Disability in Society

Dr. Rhoda Olkin theorized in 2022 that there are three key models when conceptualizing societal interactions with disability, those being the *moral model*, the *medical model*, and the *social model* (Olkin, 2022). While these three models are enough for many types of research, drawing on three additional models, which have been socially understood for some time, can help to understand the ways that disability is conceptualized outside of research. As this is a community partner-based paper as well, excluding the broader social conceptualizations outside of academia would be a critical oversight. In total, six key models of disability were identified and corroborated with a social justice webpage (Carney, 2019), those being: medical, social, economic, functional, social identity, and charity/tragedy (Fig. 1). Each model functions differently, so it is important to quickly review each and understand their implications.

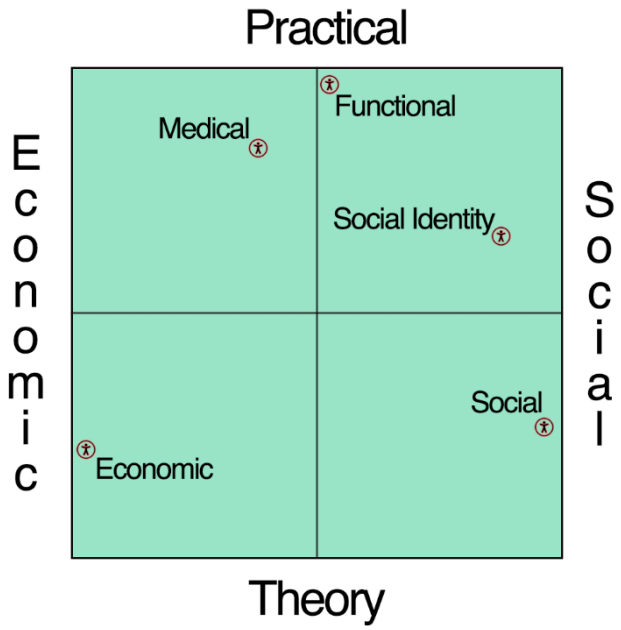

Figure 1 – A compass graph visually positioning the *medical, functional, social, economic*, and *social identity* models of disability (charity/tragedy excluded, see i. below)

The above graphic was constructed specifically for this project to help visualize the models of disability as they relate to each other.

i. **The charity model** views disability as a tragic event. The charity model is well established as an offensive model to many people with disabilities. This model has been excluded from the compass graph as it is both outdated and doesn't aim to address disability in a meaningful way other than identifying it as a problem that should be "fixed". While it is largely discredited, it is still frequently and systematically embedded in the media.

ii. **The medical model** focuses on the medically diagnosable forms of disability and aims to "solve" them through intervention. It is focused on medical intervention-based solutions and limited by the economic feasibility of treatment options which places the model in the upper left quadrant. This model is still widely used in medicine today and, while it is important to make medical advancements towards providing a better quality of life for everyone, the model can be restrictive in how people with disabilities are perceived in society. For example, if disabilities were solely viewed as something to be fixed it could propagate the charity model of disability (i) which views disability as a tragic event.

iii. **The economic model** links disability to the inability to work. It is focused on the economic effects of disability and how those effects can be mitigated. It is rooted in economic theory and, while it may aim for practical solutions through other forms of intervention, the economic model of disability only focuses on identifying the impacts that disability has on the economy. This model can become problematic as it firstly establishes a deficit-oriented narrative surrounding people with disabilities always being unable to fully contribute to the economy. Secondly, the economic model reduces the same people to only being their economic contributions or effects on national productivity. For these reasons the economic model is in the bottom left quadrant.

iv. **The social model** contrasts with the economic and medical model by aiming to break down societal barriers that inhibit those with disabilities from fully engaging in society. It naturally leans to the social side, and because it is focused on theory/understanding it is not bounded by economic constraints. These factors place the social model in the bottom right quadrant of the compass graph. One notable piece of legislation that utilized the social model of disability is the United Kingdom's Disability Discrimination Act of 1995 (UK Public General Acts, 1995). This act aimed to end discrimination for people with disabilities by addressing many key factors of life such as employment, transportation, access to services, and education. This act mandates that there must be certain accessibility accommodations across the board, and attempted to prohibit discrimination against individuals with disabilities in employment which marked the first step for social change.

v. **The social identity model** embraces disability as an identity and sees disability as a community. While still closely related to the social model, the social identity model differs by finding applications of some social theories as they relate to specific people and communities. This places the social identity model in the upper right quadrant as it is a more applied version of the social model. Vera Chouinard uses the social identity model as a foundation for her work *'Getting Ethical: For Inclusive and Engaged Geographies of Disability'*. Chouinard (2000) focuses on how geographers navigate the political landscape of disability. The paper also focuses on realising that there is no perfect solution, and we must rely on practical methods 'that empower and perhaps even advance social justice' (p.80).

vi. **The functional model** emphasizes finding practical solutions in the real world. It is not dismissive of social theory, but rather aims to find the ways that those ideals can be usefully and effectively integrated in the real world through community engagement. The

functional model must consider the medical, social, economic, and social identity models in order to be truly effective in creating the most accessible solutions. For these reasons it is located centrally between economic and social but leans far into the practical axis of the compass graph.

I position myself between the social and functional models of disability as described above. I firmly believe it is a human right to participate in society, forming the basis of my positioning in the social model. The social model is a very idealistic model that relies on a great deal of social theory, as well as expecting "perfect world solutions". If I believed that such a model would be able to be actualized, I would certainly center myself there. Currently, the social model seems like it is an excellent goal to try to reach, however, to reach that goal I also believe it is critical to understand the current extent of the accessibility movement and create functional solutions. To best achieve this, I am striving to create new and practical innovations using geographical information systems (GIS) in the accessibility space, which firmly places me in the functional model as well. For these reasons, I consider myself to hold a social-functional model of disability. I distinguish my model from the social identity model as I bring in other elements of data and understandings from fields that are not explicitly concerned with social justice, such as GIS and medical geographies.

Literature of Intersectional Subfields Contributing to Accessibility

I have identified three subfields of Geography that work together to address my overarching research question.

1) Medical Geographies and Health Geographies

Even Hippocrates had ideas that could be identified in some sense as foundational medical geography because he understood that there was an essential link between someone's health and their environment. Medical Geographies as we know it today however can be traced back to people such as Dr. John Snow, famous for identifying the correlation between water wells and incidence of disease in 1854 London during a cholera outbreak (Snow, 1855), Dr. Jacques May noted the relationship between physical, social, and biological factors and how they influence health in his revolutionary work "*Medical Geography: Its Methods and Objectives"* (1950). These works helped to set the stage for future intersectional studies in geography that revolve around health more broadly.

Snow and May really helped to lay the groundwork for people like Martin Taylor, Susan Elliott, and Vera Chouinard to create modern frameworks and understandings in both medical and health geographies. Susan Elliott, Martin Taylor, and Robin Kearns published *'The Housing Experience of Chronically Mentally Disabled Clients in Hamilton, Ontario'* (1989), and with this publication they brought a new lens to understanding medical geographies. Taylor et al. (1989) argued that those with chronic mental disabilities are severely disadvantaged in the housing market "by reason of disability and low socio-economic status" (p. 146). While it may have been socially understood that people with chronic mental disabilities were disadvantaged, this marked

a turning point in medical geographies as it is one of the first formal discussions of the issue. The article documented and highlighted the ghettoization and exclusion experienced by chronically mentally disabled individuals in Hamilton, Ontario. This spatial clustering served as a critical reflection of systemic inequities and social marginalizations. The study highlights how individuals with physical and developmental disabilities are often forced into specific neighborhoods that lack adequate resources and support systems, further exacerbating their vulnerabilities.

In addition, chronically mentally disabled individuals are systematically excluded from broader societal opportunities such as employment and social services. Taylor et al. (1989) illustrate that this exclusion is a consequence of societal attitudes and policies. They concluded that the social exclusionary practices had created a spatial exclusion, which in turn caused further social exclusion. Extrapolating this trend creates a cycle of disadvantage that is hard to break. Such a cycle could be compared to what occurs when lower income individuals are pushed out of their homes because of neighbourhood gentrification.

The Hamilton case study serves as a very clear and early geographical example of these broader issues that exist with respect to inclusivity in Canadian society. Taylor et al. (1989) conducted detailed fieldwork and interviews with mentally disabled individuals in Hamilton, providing a ground-level view of their lived experiences. They found that many of these individuals lived in poorly maintained housing, with limited access to essential services such as healthcare and social support. The study's findings helped to emphasize the importance of addressing these inequities through targeted policies and interventions that prioritize the housing needs of mentally disabled individuals. Their work helped to push the boundaries of medical geography by integrating social justice and health equity perspectives and, as such, Taylor et al. (1989) have created an early space for geographers to build from, ultimately allowing for the creation of something new.

Contrasting the functional approaches taken by Taylor et al. (1989), Vera Chouinard brought a strongly social justice focused approach to the emerging field of disability geographies. Chouinard (2000) published *'Getting Ethical: For Inclusive and Engaged Geographies of Disability'* which argued that all geographers are accountable for helping to create accessible and equitable environments. Chouinard also brought elements of feminist geographies to supplement the analysis of disability geographies. However, rather than compare the two as separate fields, Chouinard speaks to using feminist concerns surrounding oppressed groups to "challenge academic privilege and power in the knowledge production process" (p.71, 2000). Around this time, many advocates in the disability space identified that there was a need for a greater focus on *accessibility*, emphasizing the idea that those with disabilities were disadvantaged both socially and economically. The development of this field of geography in Canada was rooted in McMaster University during the late 1980s where both the social and economic models were explored respectively by Vera Chouinard, and Susan Elliott, Martin Taylor, and Robin Kearns.

Chouinard's work marked a significant turning point for the field of disability geographies, changing the focus to be on accessibility geographies instead. This shows a commitment to focusing on more practical elements of ensuring people have equitable access to

place and space, rather than simply trying to understand an issue from a deficit-oriented perspective. This switch enabled other branches of geography to create unique intersections as well, notably GIS and spatial analysis. Taylor et al.'s work (1989) combined with Chouinard's updated and modern ideas of accessibility (2000) created a unique space for a complex analysis framework to be developed.

2) Feminist Geographies and Accessibility Geographies

Feminist geography is a long-standing field of study that can be traced back in its most recent history to influential geographers like Gillian Rose (1993) and Linda McDowell (1999). It focuses on social justice, equity, and critiques the systems that have been historically systematically exclusionary. Aided by the foundational works of Rose and McDowell, feminist geography has passed through three key waves all with distinct features (Marston & Doshi, 2016). The first wave focused on wealthy white women, and the injustices they faced. The second wave identified all cisgendered women of all races, and the third wave focused on including LGBTQ2+ people. Arguably there is a fourth wave that is currently beginning which focuses more broadly on social injustice and provides a meta critical analysis of the systems of feminist geography. This fourth wave can be viewed as the intersection point between feminist geographies and accessibility geographies. It is connecting the two fields through shared experience of social injustice.

Accessibility geographies, formerly disability geographies, has a great deal of overlap with feminist geographies. Both disciplines branch from the broader social geography subdiscipline, however feminist geographies began being researched nearly 30 years before. Both branches of social geography began with a focus on predominantly white, wealthy folks. Accessibility geographies are much younger than feminist geography, and largely emerged in the late 1980s. They have still had the time to go through two identifiable waves, which share many parallels to the waves of feminist geography. The first wave similarly focused on the disabled experience for wealthy white people living in the global north and the name of the field at this time was disability geographies. The second wave was more focused on addressing the deficit narrative surrounding people with disabilities and aimed to address the social roots of the inequities to provide foundation for practical solutions. Because the field is younger, and there has been a large surge of social justice inquiries and concerns, disability geographies rapidly evolved, yet there remains a sort of social lag. This lag can be characterised by society focusing their efforts on wealthy white people with disabilities, but also trying to address the underlying social cause of discrimination. I believe we can learn from feminist geography in this regard and the more we understand these societal movements, the faster new initiatives can be moved towards inclusivity.

3) Current uses of GIS in disability studies

The application of GIS in accessibility geographies has been relatively limited. A few studies have been conducted using GIS tools. One study by Stefan Neumeir and Matthais Kokorsch (2021) targeted food deserts in rural Germany and, while it is an application of GIS onto food access, the study is not trying to address disability as this paper does, nor does it draw connections between social geographies and accessibility. The exploration of accessibility geographies using GIS and social lenses remains a largely unresearched niche. I have seen from other similarly focused projects such as the accessibility map of the UVIC campus that was created as part of my UVIC GIS capstone course with Dr. Chris Bone (Fig. 2 below) how effective GIS can be in conveying complex social accessibility issues.

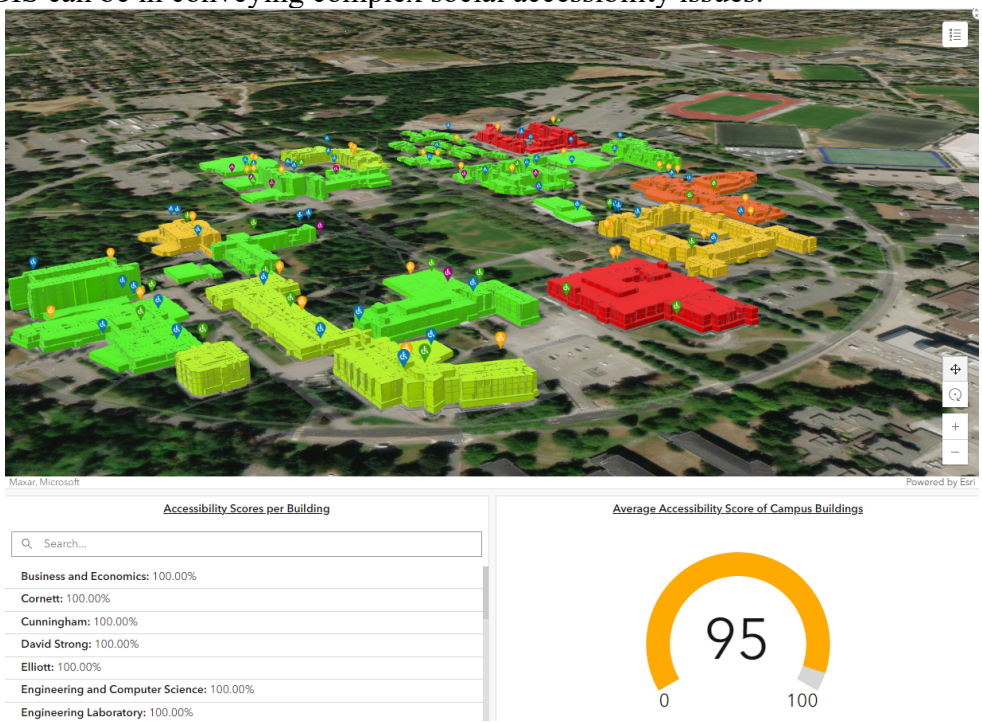

Figure 2 – Accessibility map of the University of Victoria created by my project team as part of the 2024 UVIC GIS capstone course. (Deschenes, Hall, and Mason, 2024).

This accessibility map was targeted to those experiencing forms of physical disability, and aimed to provide UVIC with more information about specific barriers that students were experiencing. Through a linked survey feature, users were able to report things such as elevators or automatic doors not working. Based on the frequency of reports, the building's "accessibility score" would change to reflect how accessible the student body deemed it. This was not only an excellent resource for finding where features such as accessible bathrooms are, but it can create a deeper and more useful web map for people with physical disabilities. This style of map can create understandings of which buildings they can access with limited barriers, and which ones may require extra time and planning until campus facilities or future planning could address challenges. In addition, the total accessibility score of the campus is a good metric for UVIC to use to understand how accessible their buildings are. While this was just a demonstration tool without user collected data, the framework was very positively received by staff and students, showing a desire for more inclusive mapping going forward.

GIS visualizations are very flexible in application and can enable organizations to focus on their mission and cut down on re-explaining the purpose and metrics of their organization to any potential funders. Overall, there is a lack of GIS being used in accessibility geographies, and because of how effective a tool it can be, I see it as necessary to develop the field as well as create frameworks for others to build from. I believe this approach has a great deal of untapped potential to revitalize and evolve accessibility geographies.

I firmly believe from my own experience and previous projects that GIS has the potential to better inform and help solve problems of access for people with disabilities. Taylor et al. (1989) reinforces this sentiment by illustrating how the spatialization of data allows for complex analysis of trends that may be present at various scales. GIS also has the potential to map qualitative points related to social equity, like those brought up by Chouinard (2000), through community mapping efforts. It can both inform the public about the issues that are faced surrounding accessibility and can help to visualize qualitative data so that the progress and impact of an organization's efforts don't go unnoticed or underrepresented.

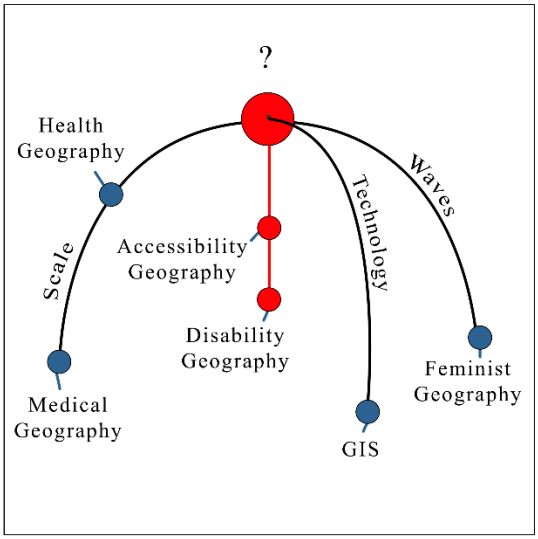

Figure 3 – Diagram produced for this project that shows Accessibility Geography intersection between Medical Geography, GIS, and Feminist Geography.

Taking a step back to look holistically at all of the relevant themes from the literature discussed thus far, Fig. 3 visually indicates the intersection of all of the subdisciplines of Geography that are crucial to understanding this project. This can simultaneously allow for a deeper analysis of existing challenges that were originally seen as standalone problems, while also helping to evolve each of the subdisciplines.

Coining the Term "Geoaccessibility"

As outlined above, disability geography has already evolved to become accessibility geography. To help the field continue to progress forward, I felt there was a lack of a term to characterize the next step in its evolution. To address this, I coined the term "Geoaccessibility" which advances accessibility geographies to include new ways of collecting, managing, and visualizing data as well as ensuring that related fields sharing intersectionalities (like feminist geographies and health geographies) are being considered and integrated.

The term Geoaccessibility is one that I coined when I began my exploration into accessibility geography. Much of the research I found on this branch of geography has a primarily social focus, usually only including a spatial reference but little analysis. I was surprised by the lack of substantial spatial analysis and visualisation, which has created a distinction in my mind between the accessibility geography that has come before me and the work that I am undertaking now. For these reasons I felt it necessary to create the term Geoaccessibility to bridge the gap between accessibility geographies and spatial analysis to create techniques that can better address accessibility challenges. I have shared this term in a handful of classes as well as projects, and it has received very positive reactions from peers, professors, and employers. Many have expressed they found the term to be intuitive and very helpful in their own understanding of accessibility, and why it is important. Because I place myself in the functional model of disabilities I am driven to create solutions. I believe that maps, as well as spatial analysis are too powerful to not use in this field, and because of that I am confident that Geoaccessibility has the potential to enact real and noticeable change in these spaces.

The need for a new term and framework can be reinforced by the work of Peter Gould (1993). Gould's book, "*The Slow Plague: A Geography of the AIDS Pandemic"* (1993) revolved around mapping the spread of AIDS in the United States, and ultimately was used to inform and create policies to help address the AIDS epidemic. The 1993 study relied on mapping out hotspots and pockets of increased density to better understand how it was spreading, and this helped to identify specific areas and groups of people who needed additional resources at the time. Gould's work (1993) greatly advanced the use of spatial analysis in medical geography and set the stage for new social forms of mapping such as Geoaccessibility.

I am attempting to build on the work of Chouinard, Elliot, Taylor, Kearns, and Gould, by bringing a new element to their foundational work in disability and accessibility geographies. I have coined this intersectional approach as Geoaccessibility. The term is one that I have created out of necessity as previously there was no term for the intersection between health, spatial analysis, feminism, and accessibility. Simply put, Geoaccessibility is a new framework to understand accessibility by utilizing existing geographic tools like GIS in tandem with social theories and health understandings. The framework seeks to understand the intersection between Health Geography, Accessibility Geography, GIS, and Feminist Geography. A visual representation of this intersection and evolution can be seen in figure 4 below.

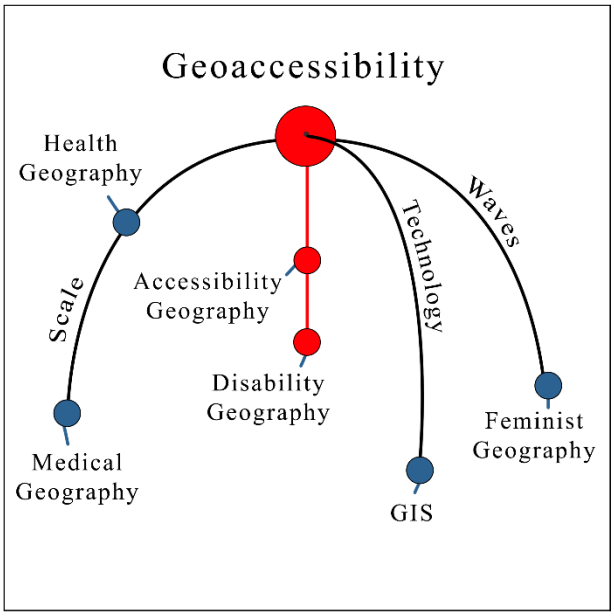

Figure 4 – Diagram of the pillars of Geoaccessibility, its motivations, and key influencing factors.

The leftmost arm of Medical and Health geographies shows the evolution of the subdiscipline, moving along the axis of scale to become more holistic, viewing health overall rather than specifically medical health. The center-right branch of GIS shows the evolution being along the line of technology innovation. The right-most branch of feminist geography depicts the field evolving across the axis of the "waves" as identified by Marston & Doshi (2016). Lastly, the center line of disability and accessibility geography shows the evolution into a positive frame of thinking, highlighting the subdiscipline's interest in moving away from a deficit-oriented narrative.

Overarching Research Questions

This project will address how GIS and mapping technologies can be used to better analyze and understand Geoaccessibility as defined above, particularly in the context of planning for health futures and accommodating individuals with complex disabilities seamlessly. Particular attention will be paid to the historical frameworks in feminist geographies, and how those frameworks have shaped, and are continuing to shape accessibility geographies. In addition, this project will also provide an understanding of how inclusive post-secondary education initiatives like the one undertaken with my community partner, STEPS Forward, can benefit from mapping and visualizations. Overall, my work will provide examples of accessibility geographies, as well as provide insights into the potential future directions of the field.

Specifically, my research questions are:

1. In what ways can GIS and mapping technologies be utilized to inform accessibility and be applied to an inclusive post-secondary education context?

2. How can we build on previous work in health geographies to inform inclusive healthy futures?

3. How can feminist geographies inform accessibility geographies moving forward?

4. How can the concept of "Geoaccessibility" help us to reconceive systemic societal norms regarding the idea of disability within Canadian society and how that can create broader access for everyone?

With these four key research questions in mind, STEPS Forward, the community partner for this project, offered an excellent way to begin exploring the implementation and effectiveness of Geoaccessibility in a specific case study context.

Chapter 3: STEPS Forward Projects

Introducing my Community Partner

The British Columbia Initiative for Inclusive Post Secondary Education, or "STEPS", is an Inclusive Post Secondary Education initiative focused in British Columbia (bc-ipse.org). They began their mission in 2001 as a parent-led grass roots initiative to see how they could support their children with intellectual and developmental disabilities to experience post-secondary education. Since 2001, STEPS Forward has supported eleven unique post-secondary institutions across the province to create their own commitment to inclusive education. The first partners, Emily Carr University of Art + Design and the University of British Columbia, began their inclusivity commitment in 2002 and 2004 respectively, Since 2021, four of the eleven partnered institutions have created their own initiative for inclusive education showing a rapid growth for the initiative, and their vision of "make(ing) it unremarkable for young adults with developmental disabilities to attend post-secondary education across BC; to be included in the same courses and programs of study, and in the same ways, as any other student on campus." (STEPS Forward, 2024).

The initiative is guided by a core set of principles, those being:

- *Applicants are interviewed to determine what they want to study, their level of motivation and their goals. Admission is not dependent on labels, academic prerequisites or IQ.*
- *Students attend their local college or university on an inclusive basis. They do not attend separate classes, classrooms or separate curricula.*

- *At least one student on each campus has significant and/or complex support requirements.*
- *Students select courses based on personal interests. As with any other student, they direct their own course of studies and select a concentration of studies in a specific field.*
- *Classroom learning is only one aspect of education. Students also participate in recreational, social, and athletic activities. During the summer they are supported to find and be employed in paid jobs.*
- *Students do not serve as research subjects, or practicum opportunities, to learn about their disability.*
- *Students prepare to become active, valued members of society and, as such, are fully involved, active, valued members of their educational community as a peer.*
- *Student educational experience is commensurate with the expectations for the experience of a typical post-secondary student.*
- *The goal of inclusive post-secondary education is to make full inclusion the norm, rather than attempting to 'normalize' students with developmental disabilities.*
- *The role of Families, or Advocates, is critical to the success of the student and as such they are encouraged to learn about inclusive post secondary education, provide input and support.*

(STEPS Forward, bc-ipse.org, 2024)

My supervisor, Professor Teresa Dawson, has a long-standing relationship with the STEPS' initiative and welcomes students supported by STEPS into her classes. It was Teresa who originally introduced me to the organization with the potential of them being my community partner. Since that time, I have been fortunate enough to continue working with STEPS and their Executive Director Arden Duncan Bonokoski to implement my budding concept of Geoaccessibility.

Over the period of my Honours and building on a directed study that allowed me to prepare for the work, I have worked with STEPS Forward to define, deliver, and analyse three distinct but related projects. For each one, I have outlined (in collaboration with the STEPS Executive Director), specific detailed research questions, methods, procedures, outcomes/results, and performed analysis on the final deliverables. The specific project research questions, and analysis of the end results, will enable me to reflect on the broader research questions defined at the end of Chapter 2 above.

STEPS Forward Project 1: Web Map of Student Diversity

In conversation with my community partner, it was clear they were concerned about differing access across British Columbia for students supported by the initiative. Therefore, I worked with the Executive Director to develop specific research questions/metrics informed by the pillars of Geoaccessibility and my own broader research questions.

Research Questions and Parameters for Project 1

The questions for project 1 were:

- What is the current landscape of accessibility in inclusive post-secondary education in British Columbia for STEPS Forward?
- How does that accessibility vary at differing scales (e.g, academic disciplines, institutions, regions)?
- What are the patterns present, and where are the gaps in service in the accessibility landscape?
- How can STEPS Forward use its existing data in order to maximize its utility and functionality to break down barriers?

The parameters for this work were very important to the community partner. Any visualisations or results produced from this had to follow the below set of requirements:

- Be publicly accessible for families to become better informed.
- Be easily updatable, and an affordable mapping solution.
- Showcase which institutions are excelling in accessibility.
- Highlight any gaps in access to allow for improved advocacy.
- Be a quickly and easily understood resource flexible in its application, particularly for any prospective funders or grants.

Methods

Through frequent communication and collaborative efforts with the community partner, it was decided that a map would be the best way to display the results because of its functionality for both public and private use scenarios. Because this was a community project, ensuring a consistent and clear stream of communication between the partner and myself was essential in delivering the best possible product. STEPS Forward had hoped to begin to solve the challenge of understanding how students supported by the initiative navigate post-secondary education. In addition, they were aiming to create a new method that could allow for the public to better understand inclusive post-secondary education, as well as an easier way to display the importance of their work to prospective funders/donors. A map was agreed upon to be the best medium to deliver this information, so existing data was provided by STEPS Forward to be mapped. The map was designed with usability in mind, allowing users to easily access and interpret detailed information about student demographics and course enrollments. This user-friendly

approach ensured that families, educators, and policymakers could understand the distribution of students across different scales (e.g. institutional faculties, academic majors, regions of BC, and the province as a whole).

With the questions and parameters in mind, I proposed that a Google MyMaps web map that could be directly accessible from the STEPS Forward website would be the best way forward. The web map was proposed to have graphs associated with each institution, as well as relevant data such as when they partnered, and alumni counts. This proposal was presented to the STEPS Forward Board of Directors in late October of 2023, where I responded to their questions, invited feedback, and was given their approval to move forward with the research project.

Project 1 was subject to the following criteria: Approval from the STEPS Forward Board of Directors, my signing of a confidentiality agreement for any sensitive information I may come into contact with, accessing all data used from their SharePoint servers (subject to their policies, procedures, and ethical requirements), and lastly, that all work done was completed on a joint access google account that they now have full control of.

For each institution, I was provided with a spreadsheet of all courses taken by STEPS Forward-supported students, as well as their declared majors for the length of time the institution had partnered with STEPS Forward. A high-level Google MyMaps web map was created of all the partnered institutions, and a description was added to them of when that particular institution joined the STEPS Forward initiative.

To improve the resolution of the data, the institution's course data was then cleaned and graphed for the web map at an academic faculty level. Two types of graphs were made, the first being a bar graph that was made for all institutions. The bar graph tallied the total number of courses that a student supported through STEPS Forward had taken in each of the faculties. By graphing this, any faculties that lacked representation or were particularly well represented could be easily identified for further exploration. The second set of graphs were pie chart style and were only produced for institutions with a large quantity of alumni (more than 10). These graphs represented student-declared majors in order to give more insight into the specific accessibility resources present in each major, and how inclusive they may be. These graphs were then linked to their respective points on the map, along with a short description of each school containing the year it partnered with STEPS Forward and total alumni.

Because the web map was to be prominently embedded in their website home screen, all stylistic and symbology choices had to be purposeful and well-considered. To ensure that the map met their standards, the abbreviated STEPS Forward favicon, using their shade of red, was used as the icon for each partnered institution. The dark base map was also deliberately chosen to contrast the white background and readability.

Outcomes/Results for Project 1

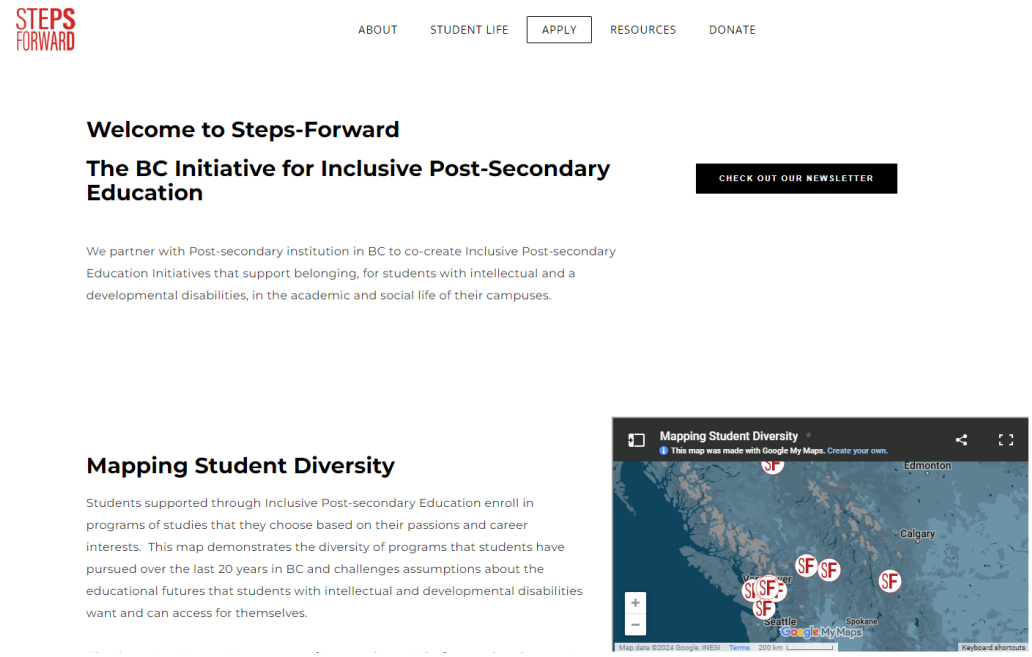

Figure 5 – Screenshot from BC-IPSE.org showing the web map embedded on the home screen.

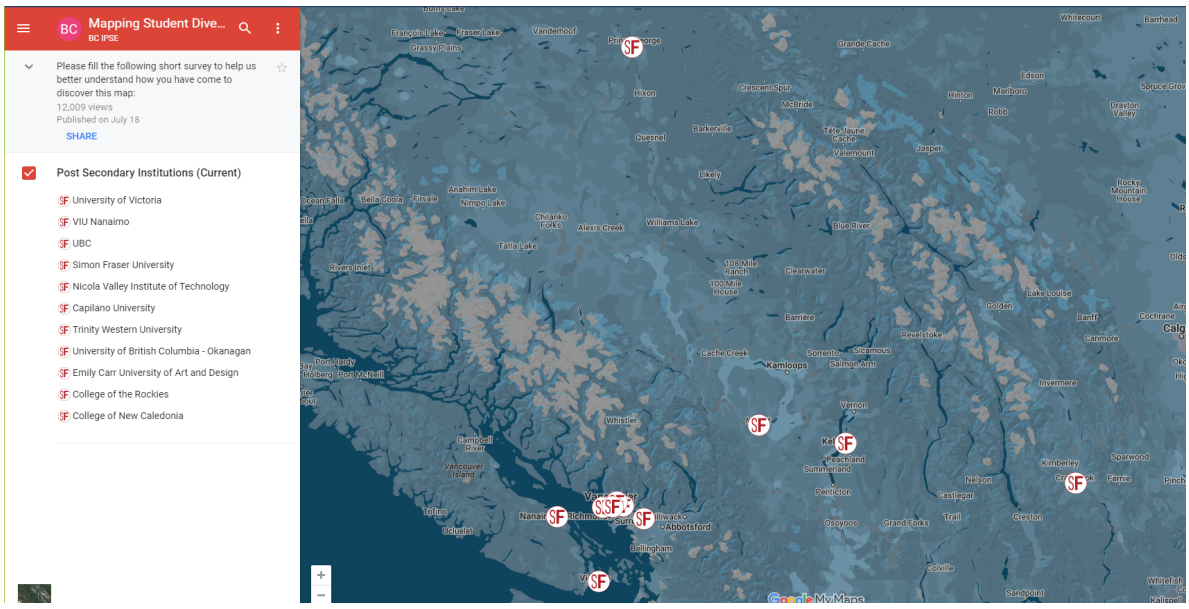

Figure 6 - STEPS Forward Partnered Institutions Map, represented by the SF favicon.

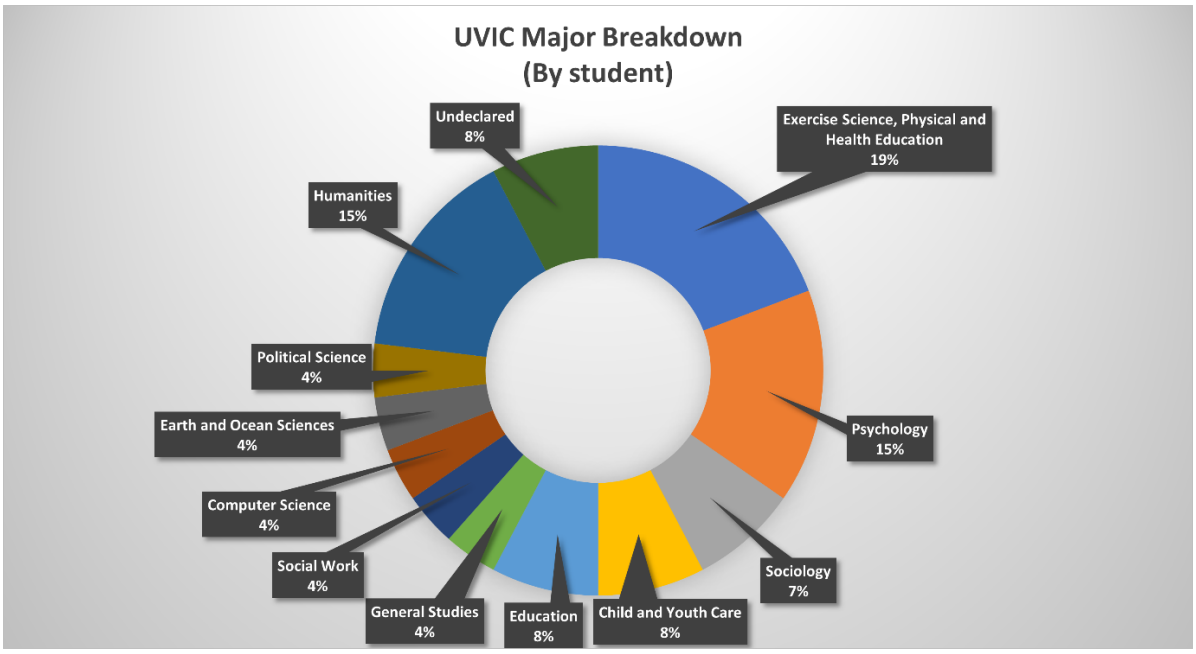

Figure 7 - Example of an academic major breakdown from UVIC

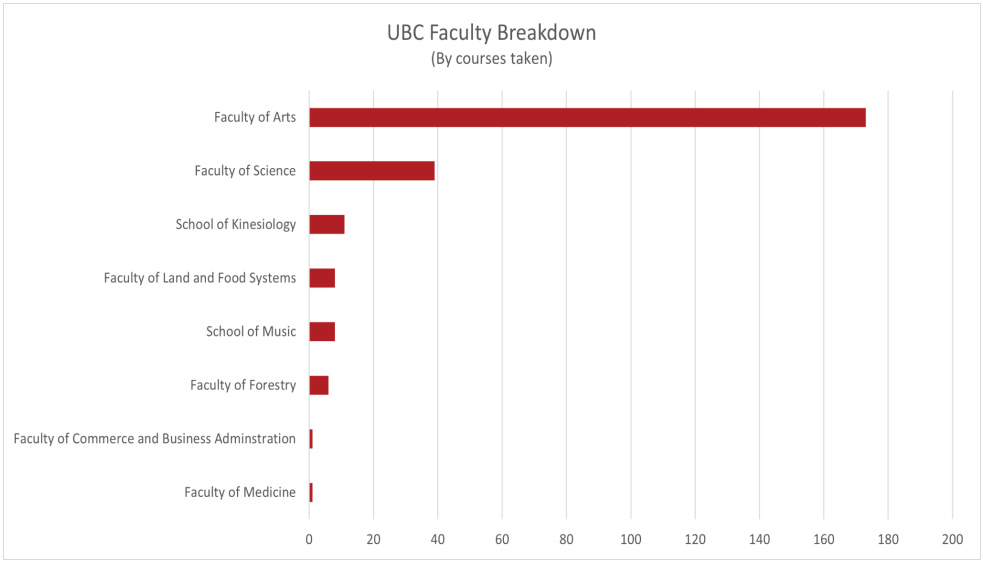

Figure 8 - Example of an academic faculty breakdown from UBC

Analysing Results of Project 1

A full set of graphs and pie charts for all institutions is available in *Appendix C*. Given the outcomes seen in the map and graphs (Appendix C), we are now better able to answer the identified research questions for Project 1, while ensuring the parameters set by STEPS Forward were met throughout.

- *What is the current landscape of accessibility in inclusive post-secondary education in British Columbia for STEPS Forward?*

  Of the major universities in BC, eight were represented on the web map. There was a notable absence of UNBC, TRU, KPU, and RRU. Of the eleven major colleges in BC, three were represented on the web map. There was a notable absence of BCIT, Douglas College, Langara College, Camosun College, and Vancouver Community College. Most partnered institutions are located in the lower mainland and Vancouver Island, with only a few outliers in the interior, and northern/southern British Columbia.

- *How does that accessibility vary at differing scales (e.g, academic disciplines, institutions, regions)?*

  An inconsistent level of accessibility was found at institutions across British Columbia, with no patterns being seen at the provincial scale. This suggests that accessibility barriers are localized to specific institutions or academic disciplines rather than occupying a specific region of the province.

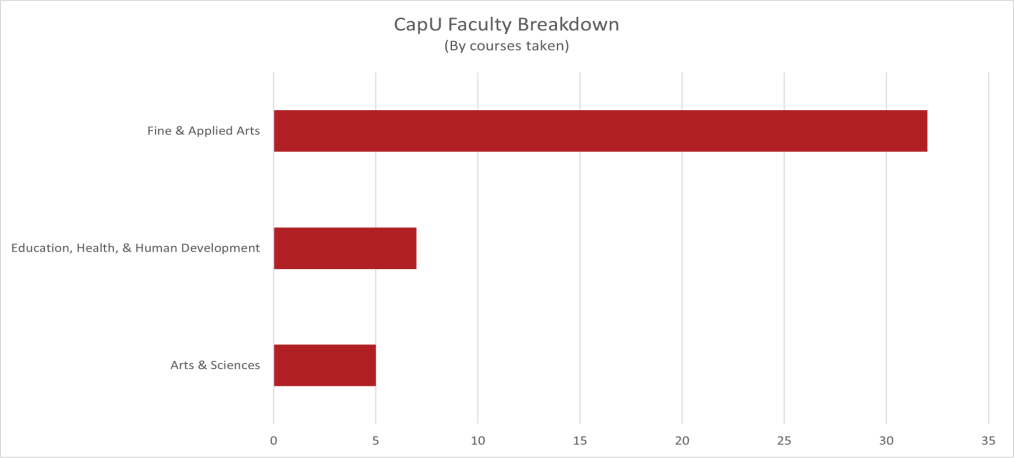

Figure 9 – Breakdown of courses taken by STEPS Forward supported students seperated by faculty at CapU as of 2024.

For example, Capilano University has a higher frequency of student in Fine and Applied Arts, while their other two faculties with course data are substantially lower (Fig. 9).

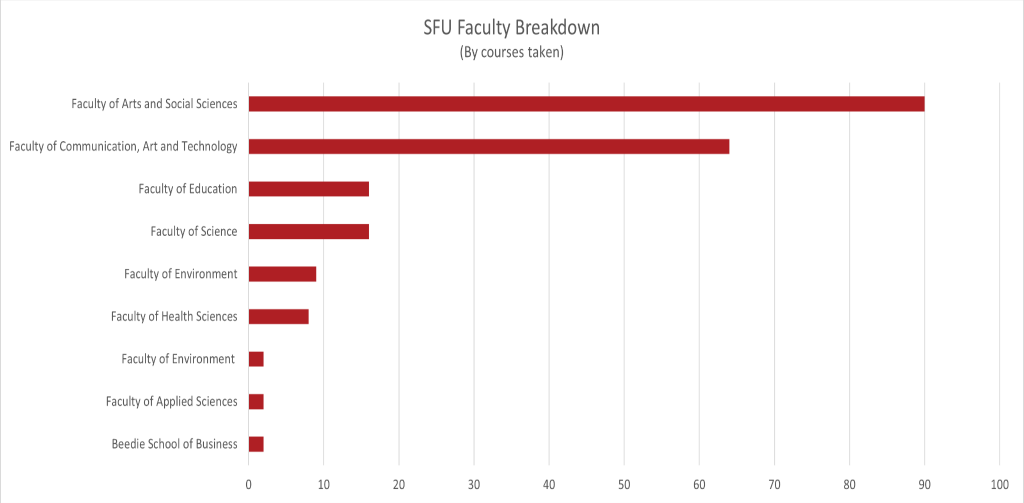

Figure 10 - Breakdown of courses taken by STEPS Forward supported students seperated by faculty at SFU as of 2024.

By contrast, Simon Fraser University has a high frequency in both Social Sciences and Communication, Art, and Technology, while their other faculties have a relatively limited number of students supported by STEPS Forward (Fig. 10).

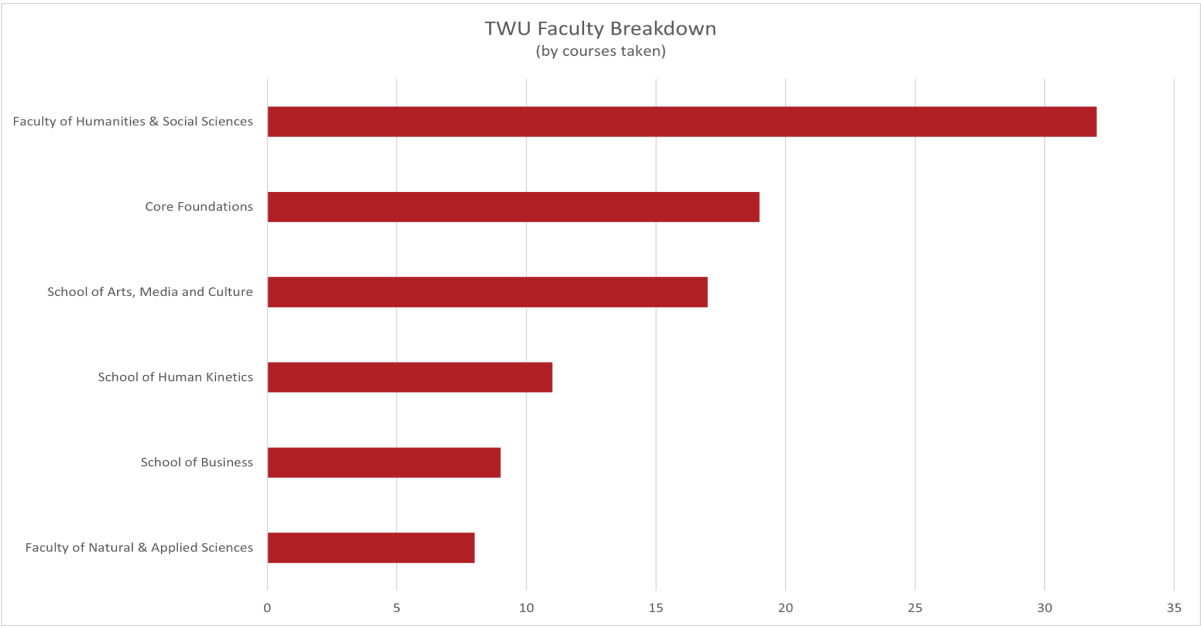

Figure 11 - Breakdown of courses taken by STEPS Forward supported students seperated by faculty at TWU as of 2024.

Trinity Western University has a relatively balanced distribution, showing good levels of access across the board (Fig. 11).

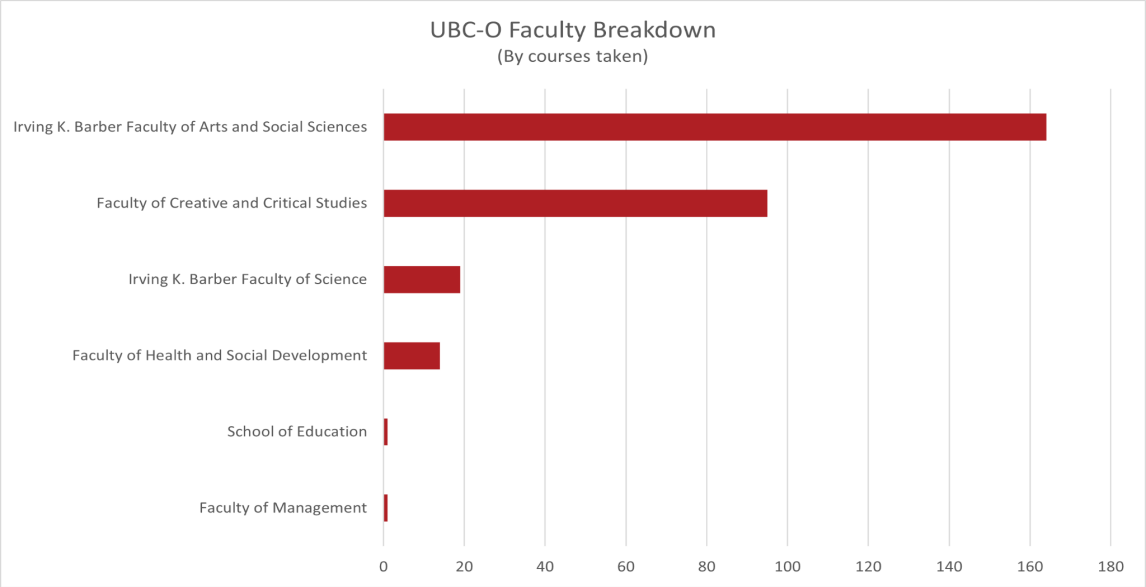

Figure 12 - Breakdown of courses taken by STEPS Forward supported students seperated by faculty at UBC-O as of 2024.

The University of British Columbia-Okanagan shows a high frequency of students in both Arts and Social Sciences, as well as Creative and Critical Studies, while their school of education and faculty of management have limited data points. This may suggest that there are some barriers present in the faculties with low frequencies (Fig. 12).

A complete collection of bar and pie charts created can be found in *Appendix C*

- *What are the patterns present, and where are the gaps in service in the accessibility landscape?*

  As seen in the above sample figures (Figs. 9-12), Social Science and Humanities are consistently at the top of the graphs for courses taken by STEPS Forward supported students. Other patterns are not consistent across all institutions. On an individual institution scale there are indicators that there may be discrepancies between the overall student population in each faculty compared to STEPS Forward supported students taking a course in that faculty (e.g. Science or Fine Arts). Some of these discrepancies, such as the limited observed frequency in the Arts and Sciences at CapU could be explained through a small sample size or variations in student interest, however in the case of larger institution like UBC-O the lower frequency faculties should be evaluated on a case-by-case basis to ensure that there are no barriers preventing students from continuing down their desired pathway. Beyond this, there is a lack of a generally discernible pattern across the accessibility landscape.

- *How can STEPS Forward use its existing data in order to maximize its utility and functionality to break down barriers?*

The initial application of STEPS Forward's data to the web map was successful in laying the groundwork for this project. I was then asked to present these results at the AGM on November 14th, 2023. At the AGM I explained how the map was created, and how it could be used to improve workflow for STEPS Forward employees. This question was a large driver for continuing work with STEPS Forward, and advancing into project 2.

Future Directions/Considerations for Project 1

With the completion of Project 1, the need for the further exploration of potential reasons for the observed trends, such as the high Social Science/Humanities representation across all partnered institutions, became apparent. There was also a need to understand the full application and utility that the web map can have to reinforce the STEPS Forward mission to gain a more holistic overview of the entire research project.

STEPS Forward Project 2: The Implications and Utility of the Web Map for Inclusive Post Secondary Education

The results of Project 1 were presented to the STEPS Forward Director and Board, who then expressed a desire to continue the project and begin a more in-depth analysis of patterns and relationships in the data, as well as an application-focused view of the web map. This allowed for a new set of research questions to be built upon those identified in Project 1.

Research Questions and Parameters for Project 2

The research questions identified in Project 2 were:

- Can we document the utility and functionality of the STEPS Forward web map, and Project 1 for advancing the STEPS Forward mission?
- How can the results of Project 1 be used to inform future advocacy strategies and support STEPS Forward facilitators in their work?
- How can we draw on the expertise of on-the-ground employees to improve the reach of the initiative?

All of the parameters identified in Project 1 remain present in Project 2, with the addition of being asked to engage both the facilitators and the STEPS Forward community (e.g. students, alumni, and families in the project).

Methods

STEPS Forward was the first applied case of Geoaccessibility techniques I had tried. Project 1 produced a map of the diversity of students' academic interests and the institutions at which they had chosen to study. Project 2 was designed to build on the web map to better understand its full reach and usability while employing both qualitative and quantitative methods.

To achieve these goals, the growth of web map usage was tracked by view count, which began counting each visit to the map in early November 2023. Anecdotal comments from facilitators were also noted at the first AGM in November 2023 of how they were using the map to enhance their work. Additionally, I attended the STEPS Forward Centre for Expertise symposium on May 1st and presented the findings of the project to a group of roughly 60 participants from across Canada who had a vested interest in inclusive post-secondary education. Lastly, I was requested to write a two-page newsletter piece for STEPS Forward (STEPS Forward, 2024, p.8-9) that gave an insight into the web map, its applications, and why the work is important. This was done to engage the community and inform them of the new web map tool that they could now access.

Outcomes/Results for Project 2

Quantitative Data

Since the web map went live in November of 2023, it has continued to grow and is currently up to 12,021 total views (as of Aug 1st, 2024).

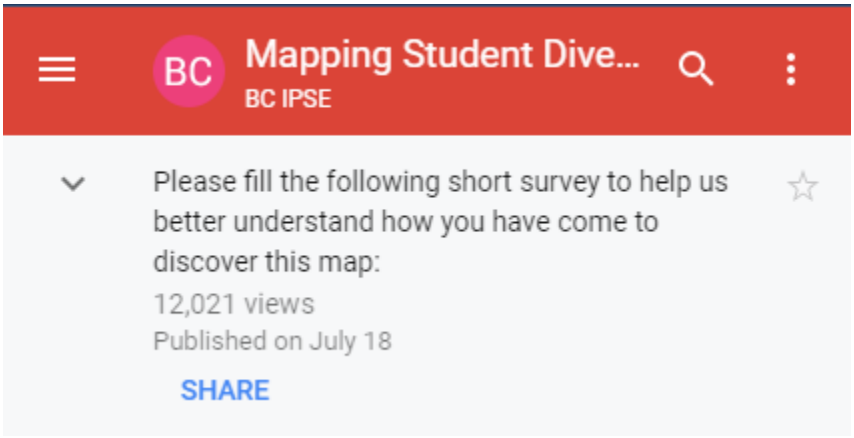

Figure 17 – View count of the STEPS Forward Web Map

The following figures are the results that I presented at the Centre for Expertise's Symposium

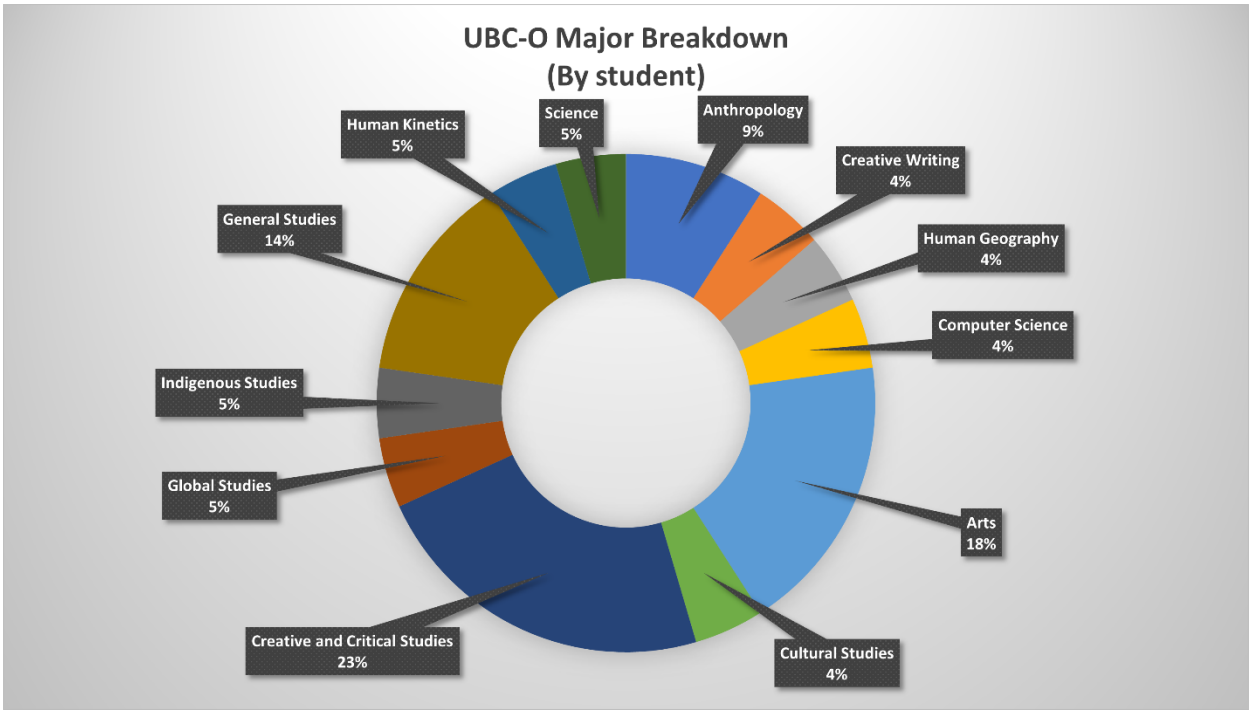

Figure 13 – Breakdown of declared majors at UBC-O for STEPS Forward supported students.

A large percentage of students have declared academic majors in Arts and Creative/Critical studies at UBC-O, which may allude to effective inclusive practices that could be further investigated to see what they are doing differently. There is also a good diversity of other majors, showing that UBC-O may be an example to follow for inclusivity standards (Fig. 13).

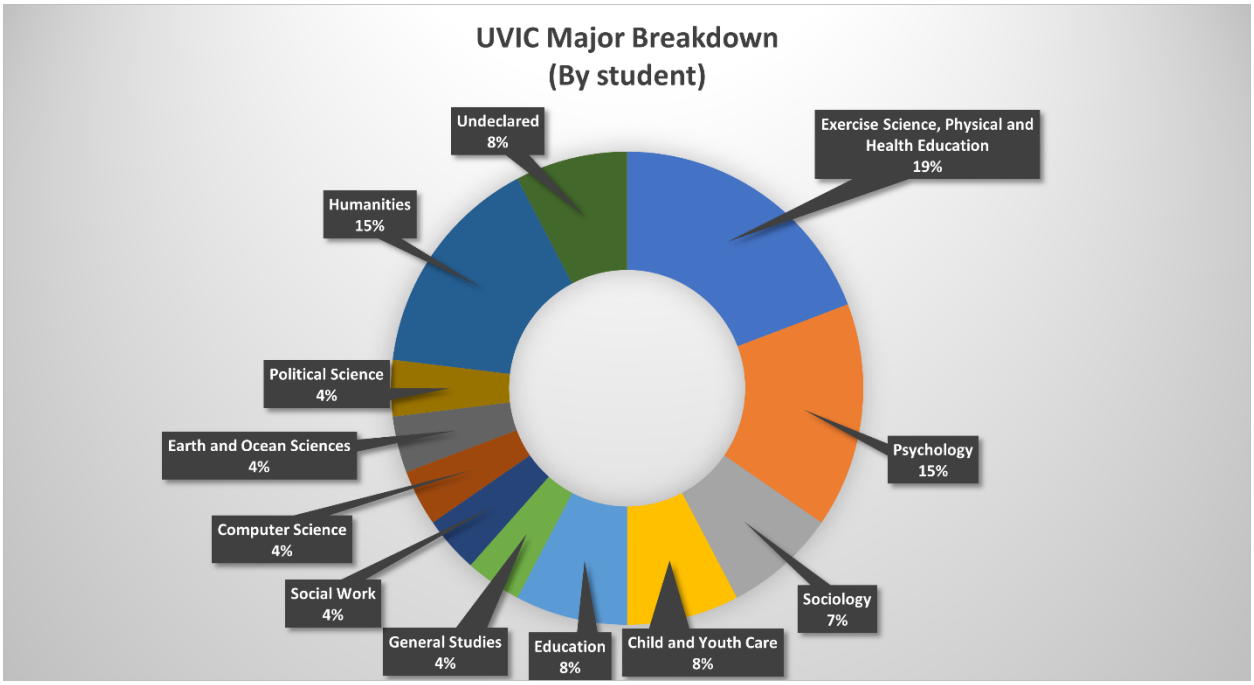

Figure 14 – Breakdown of declared majors at UVIC for STEPS Forward supported students.

The UVIC academic majors breakdown has an emphasis in Exercise Science and Psychology, which can suggest that those departments/faculties are generally inclusive. Like UBC-O, there is also a good diversity of other majors, showing that UVIC may be an example to follow for inclusivity standards (Fig. 14).

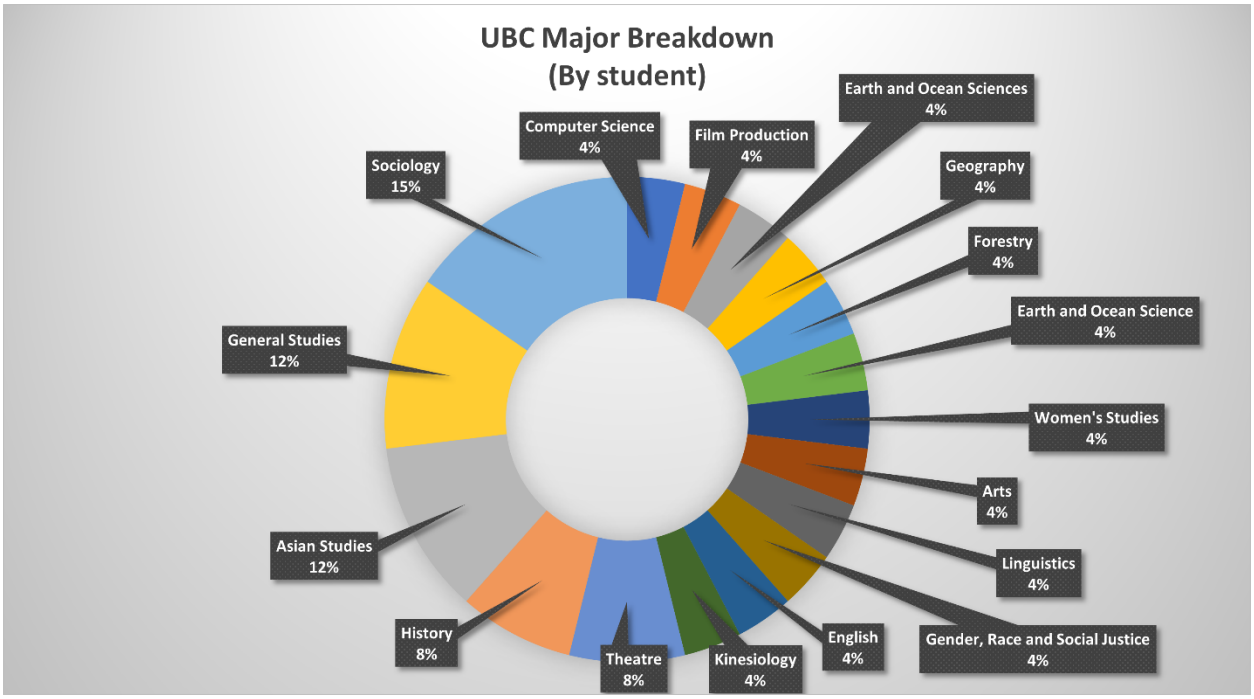

Figure 15 – Breakdown of declared majors at UBC for STEPS Forward supported students.

The UBC academic majors breakdown only has a notably higher number of students in Sociology. Given the size of the institution and the breadth of declared majors, this may reflect student interest. It may also suggest that Sociology has a particularly welcoming professor or good resources in place, which would suggest that UBC is a particularly inclusive institution in supporting STEPS Forward supported students to truly choose their own pathways.

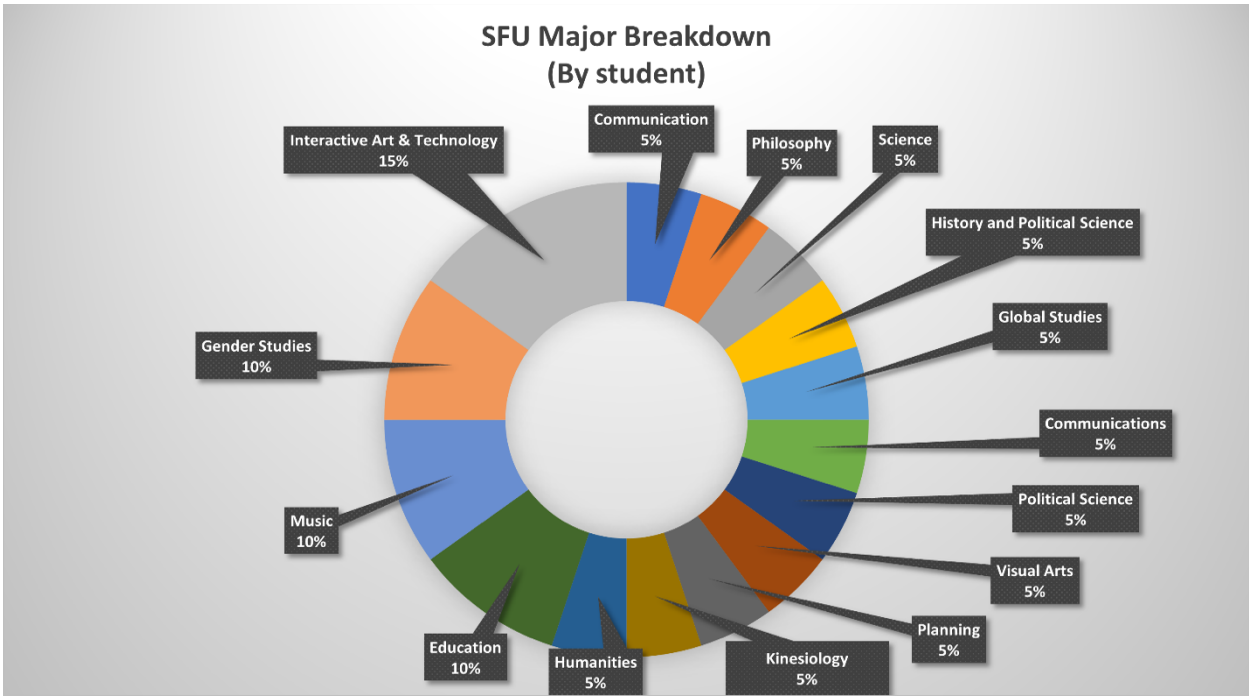

Figure 16 – Breakdown of declared majors at SFU for STEPS Forward supported students.

Very similar to the UBC Major breakdown, the SFU graph has a wide breadth of declared majors, suggesting that SFU is inclusive in allowing STEPS Supported to pick their pathways (Fig. 16).

While it is common for research to identify trends in data, this project identified the lack of a notable pattern across declared majors, which creates a pattern in and of itself. When looking at *Figure 16*, representing a declared major of a student who has engaged in inclusive education at SFU, a story of student diversity of academic interests became visible. I feel it is important to note that the higher frequencies seen in the Humanities may not be a result of a more inclusive program. The observed higher frequencies could instead be related to interest in that subject, lack of support in other faculties, or another variable unrelated to accessibility.

Qualitative Data

While at the AGM and the Centre for Expertise symposium, an informal polling of how the map was being used to support the work of STEPS Forward Employees and how the map from Project 1 was benefitting the broader community was taken. The facilitators shared that they felt the web map had:

- A simple, and intuitive design.
- Reduced the time needed to explain inclusive education, and its importance to funding organizations.
- Already been effective to help inform a family about STEPS.
- Seen exciting new possibilities with the web map.

- A revitalized commitment/increased engagement to their work, with one facilitator sharing “It’s awesome to see how STEPS has grown, this makes me feel really good about the work we do”.

The invited newsletter piece (STEPS Forward, 2024, p.8-9) that was also written as part of the dissemination and engagement of this project can be viewed in its entirety in *Appendix B.*

Analysing Results of Project 2

Everyone involved with Project 2 was enthusiastic with the viewcount of the map reaching over 12,000 views in less than nine months. While the 12,021 views may not correlate to 12,021 unique individuals, it is a strong indicator of a growing interest in inclusive post-secondary education (Fig. 17).

When the declared major graphs were analysed and compared, a pleasantly surprising lack of a pattern emerged in terms of academic subjects that students were taking. This lack of a pattern was a major component in redefining the goals of the first project, as now STEPS Forward was able to use the map to communicate the positive story of student diversity of academic interests, in addition to its uses as a tool for analysing accessibility.

Once the map of student diversity of majors was completed, it was presented at the STEPS Forward Annual General Meeting, as well as at the Centre of Expertise for Inclusive Post Secondary Education’s annual symposium on May 1st, 2024. During these meetings, I was able to discuss the impact of the map and while this was still early in the entire project, there was considerable evidence that facilitators and STEPS Forward community members were very engaged and interested in the future applications of the web map. They also used the web map as a good point for self-reflection on how far the organization has come since its inception and the importance and value of their work.

Future Directions/Considerations for Project 2

Moving on from Project 2, my community partner hoped that future research would address understanding how students had come to be connected to STEPS Forward originally. This would then help to give insights into student’s unique journeys to finding STEPS Forward and Inclusive Post-Secondary Education. Learning from these unique experiences could help increase accessibility across the initiative for other students. Understanding how far are people willing to go for inclusive education is also another component to be further researched. This can provide a unique perspective to understand the accessibility of a particular institution.

STEPS Forward Project 3: Mapping High School Data to Determine Inclusive Reach

Being informed by feminist and health geographies, and the original goals of Geoaccessibility, the is the next logical step to improving accessibility for STEPS Forward supported students is to understand how they come to find the initiative. This led to the next set of specific research questions for Project 3.

Research Questions and Parameters for Project 3

The research questions identified in Project 3 were:

- Which high schools are students coming from before joining the STEPS Forward initiative, and are there "feeder" high schools for the initiative?

- How did supported students learn about STEPS Forward, and are there key influencers who recommend the initiative? (guidance counselor, teacher, family, etc.)

- How far from home are students willing to go to attend the institution of their choice, and is their access directly related to distance?

- What could be learned from these unique student experiences that could help increase accessibility across the initiative for other students?

Once again, this project followed the same parameters of the previous two with the additional requirement that no work could be done directly *on* STEPS Forward alumni (e.g. no interviews).

Methods

STEPS Forward developed and distributed a survey, specifically requesting my expertise in shaping the questions and questionnaire design. This survey was part of a broader survey that STEPS Forward was planning to conduct and addressed other alumni data points that were not relevant to this report (Note: The terms of my prior confidentiality agreement remained in place, and I was never in a position of ownership over the data). A copy of the questionnaire can be found in *Appendix A*. STEPS Forward distributed the survey using Microsoft forms and they were sent out at the end of March 2024. The results that STEPS Forward wanted me to analyse were tabulated, cleaned, and mapped in April, 2024.

To better convey my community partner's goals, I began by developing a measure called "Inclusive Reach" to define the metric I was analysing. "Inclusive Reach" can be defined as the total distance an individual student traveled to their STEPS Forward partnered institution in kilometers. This metric was inspired by the work of social and medical cartographers such as Peter Gould. As discussed above, Gould's (1993) work laid the foundation for using spatial analysis to tackle complex social problems, influencing the development of Geoaccessibility techniques in education.

The data was taken, cleaned, and georeferenced in ArcGIS to provide point data for each high school associated with the alumni. The point data was then analyzed by the software for clusters of high schools, and a heatmap was generated based on the density of the clusters. Yellow was assigned to be areas of high density, while red represented low density, and no colouring represented no high school data in the area.

In the initial map generated in Project 1, the results were skewed towards areas of higher population and may not explicitly identify patterns of inclusive education awareness. To correct for this, the original heatmap was overlayed onto a population density map of British Columbia to create a new map that highlights areas that have high or low representation based on the population density.

Building on this first heatmap, population data from the Canadian census (2021) was added to the heat map so that the data was normalized to account for differences in population density. First, a weighted heatmap of British Columbia was constructed using the provincial census boundaries as a guide. The data cleaning consisted of finding the specific population data for each census region from a list of 57,334 total entries. The data was then joined to the shapefile of British Columbia to create a general population heat map. At this point, using the "intersect" tool, all STEPS Forward high school data points were counted in each region, providing a new column heading of "count of high schools in region". This new column was added into the graduated colours symbology tab, and the normalization of the graduated colours was set to be the population that had been joined to the dataset before.

Following a very similar process, a map of specifically the "Greater Vancouver" census region was created using subdivisions. This dataset being a higher resolution required more data filtering to identify the population for each subdivision. The total dataset was exactly 1,048,576 rows, all of which were ID searched for the 27 subdivisions in the "Greater Vancouver" census region, and then were further filtered to identify the population value. From this point the data was joined and symbolized in the same way as the British Columbia map.

The ratio of high schools attended by students in each census region to the region's population as a whole creates a normalized gradient, highlighting areas with particularly high or low densities of potentially inclusive high schools (essentially STEPS Forward high schools per capita). Expressed as a simple formula, the ratio is:

$$\frac{\text{Total count of high schools identified in the STEPS Forward survey per census division}}{\textit{Population of the census division}}$$

To construct the map of furthest inclusive reach (largest catchment area), I georeferenced the high school data and linked it to its respective post-secondary institution point. From this point, the X,Y coordinate data for both the high school and the institution could be connected through the creation of a new feature layer using arced lines. By finding the point with the furthest distance to each post-secondary institution, a

simple measure of "inclusive reach" was created. In both the case of the heatmap and this inclusive reach map an inset map was added for the lower mainland to enhance visibility as the density of datapoints in that area made viewing from a province-wide scale very challenging. The maps were provided to the community partner to be distributed and utilized at their discretion.

Outcomes/Results for Project 3

The survey of high school data had a high response rate of 54% (35 responses of the 65 sent), helping to validate the findings in the analysis of the Project 3 results.

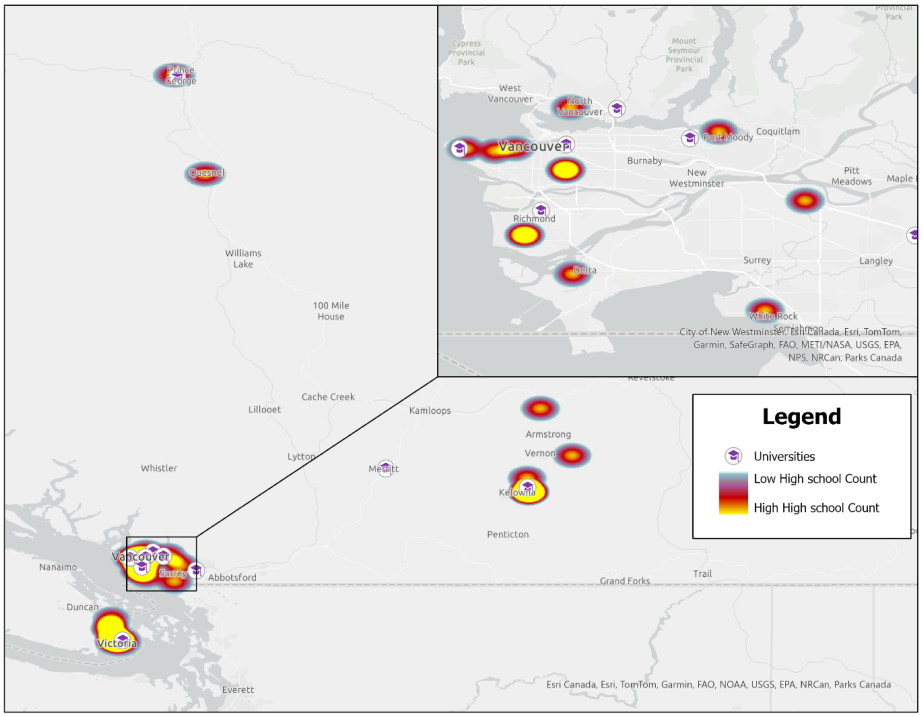

Figure 18 – Heatmap of high schools that STEPS Forward supported students attended

The highest density of feeder high schools is seen around Vancouver and throughout the lower mainland. Other hotspots can be seen in Kelowna and Victoria as well. Smaller low-density clusters are dotted throughout the interior, with very low to no density in northern British Columbia (Fig. 18).

Heatmap of STEPS Forward alumni high schools normalized to Census population data.

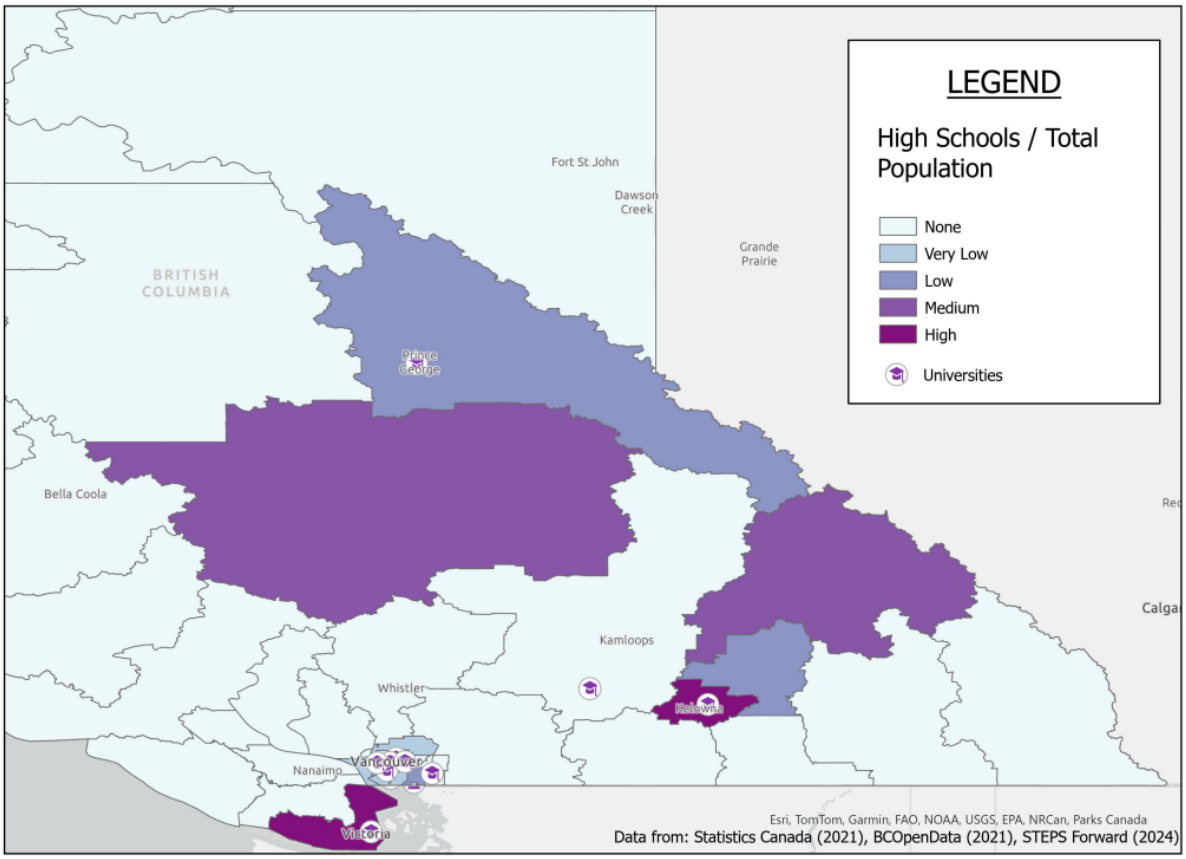

Figure 19 – A heatmap of British Columbia showing the ratio between high schools attended by STEPS students, and population size in the region (darker represents a greater discrepancy in the ratio between high school counts and population size). Source: Population data and census boundaries taken from Statistics Canada (2021) and BCOpenData (2021).

When corrected for population density, the heatmap of STEPS Forward Alumni High Schools can now be viewed per capita. Darker regions like those around Victoria and Kelowna indicate a particularly high count of high schools per capita, while light areas represent a particularly low count per capita. To see an enhanced view of Greater Vancouver, please see Figure 20 below.

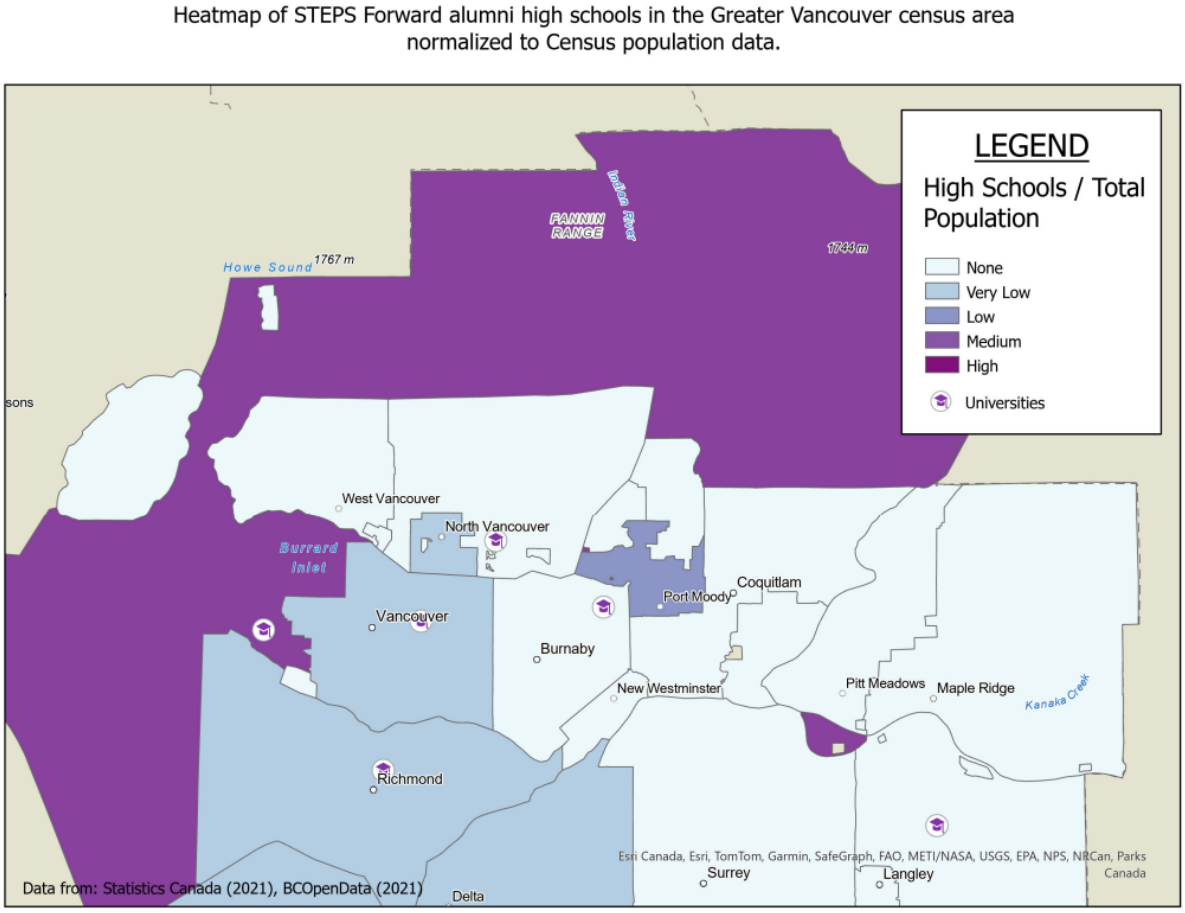

Figure 20 – A heatmap of all subdivisions within the full census division of Greater Vancouver. The map visualizes the ratio of high schools attended by STEPS students to the region's population size. Source: Population data and census boundaries taken from Statistics Canada (2021) and BCOpenData (2021)

When corrected for population density, specific pockets around Metro Vancouver and Port Moody show a greater discrepancy between the total count of high schools and the population of the subdivision. This implies that the darker regions are more informed about STEPS Forward supports, while the lighter regions may require targeted intervention and education on STEPS Forward as a resource.

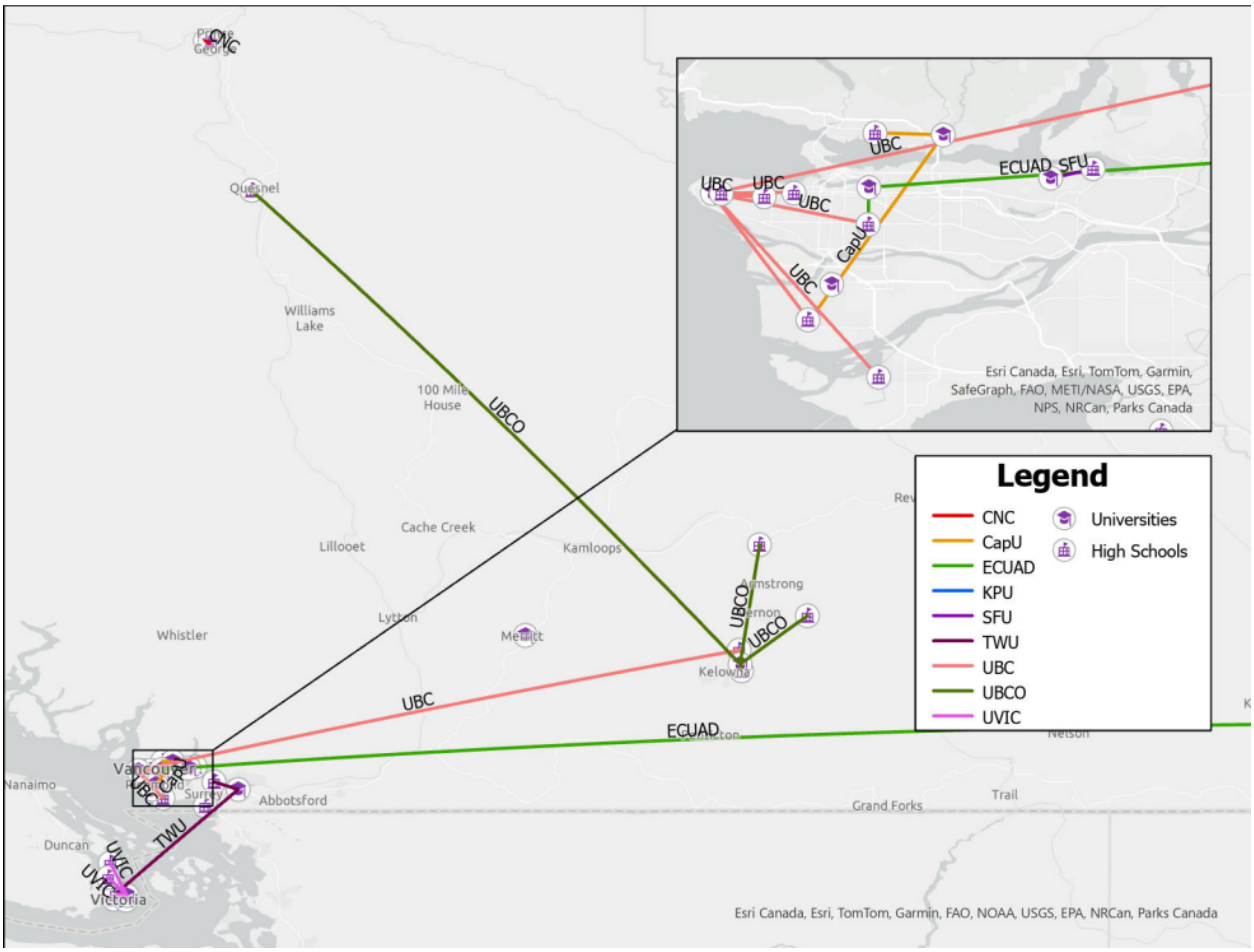

Figure 21 – Inclusive reach map of high schools that STEPS Forward supported students attended, with leader lines to the post secondary institution they chose. Colours represent the specific higher education institutions that a student traveled to.

The largest reach was from Quesnel to UBCO, a distance of approximately 550km, while the smallest reach was found in Prince George at CNC, a distance of less than 1km. The lower mainland, specifically Vancouver has a very high density of students who have not needed to travel outside of the city to go to UBC. The average inclusive reach of an institution usually does not extend past the city boarder. (Fig. 21)

Analysing Results of Project 3

While the web map created in Project 1 focuses on useability for the public, the heatmap (Fig. 18) can give unique insight into areas where accessibility may be thriving, or where it has room to grow. The heatmap represents where students have attended high school, which may suggest a greater awareness of certain accessibility services, in this case the service being STEPS Forward initiative. This visualization helps to identify areas that are

successfully supporting inclusive education and those that may require additional outreach and resources.

To further enhance the analysis and account for a possible skewing of data towards areas of higher population, a population density overlay was added to the heatmaps and was the normalizing field for the original heatmaps (Fig. 19-20). This addition allows for a more nuanced understanding of accessibility awareness by comparing the representation of students using accessibility services to the overall population distribution. By doing so, it becomes possible to identify areas with significant disparities in accessibility awareness and utilization. For instance, a high concentration of students using accessibility services in a region with a lower population density may indicate effective outreach and support programs. On the other hand, areas with low representation despite high population density may highlight gaps in accessibility services and awareness. This unique analysis provides insights for policymakers and organizations like STEPS Forward to target their efforts more effectively and ensure equitable access to education for all students. While these heatmaps may not directly suggest that the areas of higher frequencies are more inclusive, it does suggest that these are areas that are aware of and rely on STEPS Forward for inclusive post-secondary education.

The flexibility and adaptability of these maps are essential to their success and usefulness. By allowing them to be modified to address various types of accessibility barriers, they can remain relevant and useful for a wide range of needs, ultimately helping to foster healthy futures. These maps can serve as a template for future Geoaccessibility projects, providing a robust framework that other researchers and organizations can build upon. The ongoing development of these tools can contribute to a deeper understanding of the impact of Geoaccessibility and help to drive the implementation of new solutions in the accessibility space.

The idea of “inclusive reach” also works to inform the accessibility of each post secondary institution. By measuring the total distance that a student would travel to attend a particular school, a unique metric that connects the reach of an institution with its accessibility features is created. It is also important to note the impact of moving for students with intellectual disabilities. There are typically added complexities like creating a new support system in addition to all of the regular challenges students face when moving away from their family home. Because of this, the challenges from each individual move should not be underestimated. As seen in *Figure 21*, one student traveled from Quesnel to UBCO which is a roughly 550km distance. This gives UBCO a particularly large inclusive reach and helps to verify their commitment to inclusive education.

While this is useful, it is important to distinguish that this is a measure of practical inclusive reach, and not the maximum inclusive reach. To obtain the maximum inclusive reach, this model would have to consider those who are informed and wish to attend a particular school but are unable to for various reasons such as income, necessary external supports, or social pressures to pursue special education programs. To fully model

maximum inclusive reach, questions would have to be integrated into a survey like the Canadian Census, which is currently not a possibility.

Future Directions/Considerations for Project 3

Concluding the outcomes from Projects 1-3, and learning from the specific context of working with STEPS Forward, a few goals have been identified as future directions and considerations. The first possibility would be to expand the mapping system to include likeminded organizations beyond British Columbia, such as Inclusion Alberta. This could create a more useable resource for not only those in British Columbia, but all of Canada more broadly. Secondly, because the Canadian Census data was a backbone of the population adjusted heatmaps, comparing not only population but other social factors such as income, race, and gender to see their impact on inclusive education would be an important next step to enhance the work done in these projects.

Chapter 4: Building a Geoaccessible Future

As a result of the detailed work conducted with the community partner, STEPS Forward, I am now able to critically reflect on the original broader goals and research questions of my dissertation, and use this to create a model for future work.

5. In what ways can GIS and mapping technologies be utilized to inform accessibility and be applied to an inclusive post-secondary education context?

6. How can we build on previous work in health geographies to inform healthy futures?

7. How can feminist geographies inform accessibility geography moving forward?

8. How can the concept of "Geoaccessibility" help us to reconceive systemic societal norms regarding the idea of disability within Canadian society and how that can create broader access for everyone?

Reflecting Back on the Overarching Research Questions

In what ways can GIS and mapping technologies be utilized to inform accessibility and be applied to an inclusive post-secondary education context?

GIS and mapping technologies can be utilized in many different ways to inform accessibility and be applied to inclusive post secondary education. GIS allows for the spatial analysis of data, which can help to visualize accessibility in a new way, allowing for the identification of patterns that may have been otherwise overlooked. Highlighting the spatial dimension creates unique opportunities to explore other social barriers to inclusive post-secondary education in the future such as income, race, gender, disproportionate first nations representation, or chronic illness.

Traditional data analysis methods often halt at basic graphing in programs like Excel, limiting their utility. However, mapping data transforms it into a more powerful visualization tool, enhancing its effectiveness and usability. This approach serves as a foundational framework for ongoing studies at the intersection of spatial analysis and accessibility, laying the groundwork for future research and interventions. This spatial perspective is important for developing more effective and equitable accessibility policies and practices. Existing data analysis regarding accessibility typically is stopped after it is graphed using a spreadsheet program like excel. However, by mapping out this data there are many more uses which ultimately increases the effectiveness of the data. Drawing from the Mapping Student Diversity study created in Project 1, because the results were accessibly mapped, the public now has a useful tool for their own understanding of inclusive post secondary education as well as STEPS Forward leadership having a useful tool to gain insights into areas that are less or more inclusive in their education practices. Facilitators can also rely on the maps created in their day-to-day work with their institutions. GIS is also a particularly advantageous foundational tool for supporting Geoaccessibility as it is an easily expandable format. Adding similar like-minded organizations

such as *Inclusion Alberta* can only strengthen resources like the STEPS Forward web map, creating a more powerful tool for everyone, ultimately leading to a nation-wide resource.

How can we build on previous work in health geographies to inform healthy futures?

Building on previous work in health geographies, authors like Peter Gould (1993) have shown why it is so important to map health issues. By heatmapping the spread of AIDS in the United States, he helped to prove the importance and power that bringing a spatial component to the discussion can be in understanding and addressing a problem.

Accessibility barriers continue to exclude many individuals from society, so by mapping these barriers we can better understand and visualize both how space impacts the barriers, and how the barriers can impact space. Geoaccessibility also allows for a deeper understanding of how the barriers were created or are being maintained. Incorporating intersectionality into health geography could further enhance our understanding by connecting various social determinants of health, such as income, race, and gender, with geographic factors. This holistic approach could ensure that all aspects influencing health are considered. I strongly believe that Geography can continue to build on the foundational work of Gould, Taylor et al., and Chouinard, allowing for the further integration of spatial analysis into health geographies to create healthier futures for all.

How can feminist geographies inform accessibility geography moving forward?

Feminist and health geographies have historically addressed social issues related to race and gender (amongst many other topics as well). These efforts have effectively highlighted disparities and provide valuable insights into how different communities experience accessibility and inequality. For example, health geographers like Taylor et al. (1989) have used mapping to reveal disparities in access to housing, providing a powerful tool for advocacy and policy change. The success of these projects shows the potential of Geoaccessibility techniques to similarly impact accessibility geographies.

To ensure that accessibility geographies can quickly advance through the necessary "waves" of a social movement, it is beneficial to draw on the experiences of similar movements that have already navigated the complexities of social change. For example, feminist geographers such as Vera Chouinard have extensively documented the significant barriers faced by marginalized gender groups. Chouinard's work provides critical insights into social injustice and the strategies that can be used to overcome barriers. These insights contribute to a broader understanding of social justice and equity, providing a foundation for accessibility geographies to learn from feminist geographies. By incorporating lessons from feminist geographies, such as the need for greater inclusivity earlier on, accessibility geographies can better address the systemic challenges faced by individuals with disabilities and accelerate the development of intersectional inclusive policies and practices. This cross-disciplinary approach not only enriches the field of accessibility geographies but also promotes a more comprehensive and integrated understanding of social justice issues.

All of the mapping work I have undertaken thus far has been largely informed by feminist geography ideas, especially those surrounding equity and a right to access. From this relationship, a clear correlation between the waves of feminist geographies and accessibility geographies became clear to me. Geoaccessibility has proven to be a useful framework to repurpose existing data and help to provide a fuller picture of potential barriers to access. By using philosophies and ideologies from feminist geographies as a cornerstone for Geoaccessibility, it can be ensured that the newly proposed framework is *for* the community rather than being done *on* the community. These same philosophies guide the idea that research done using the Geoaccessibility framework must be easily available to the community so that everyone can come to their own conclusions from the data. Ensuring the results are available to the affected community members is paramount to the effectiveness of Geoaccessibility.

Geoaccessibility: The ACCESS-Solutions Model

How can Geoaccessibility help us to reconceive systemic societal norms regarding the idea of disability within Canadian society and how that can create broader access for everyone?

I have developed the following standalone Geoaccessibility infographic to outline the logical steps in implementing the Geoaccessibility framework to future initiatives. The following ACCESS-Solutions model is a mnemonic representing the steps taken in the framework, those being: Assess, Collect, Chart, Examine, Spot, Summarize, and Solutions.

Assess - Identify potential barriers to access (wage, class size, wheelchair access, etc.)
Collect - Gather your data through partnerships or fieldwork. Ensure it has a location attached to each entry!
Chart - Map your data - free tools such as Google My Maps can work great for most purposes.
Examine - Look for any pattern (or lack there of) that may be notable in your map.
Spot - Identify potential causes of barriers, while they may not be correct it is a launching point.
Summarize - Reflect on your process, ensuring you have fully considered the experience of the community.
Solutions - Going beyond the framework, take actionable steps toward researching and removing the barriers.

To see the steps in further detail, please read the infographic below (Fig. 22), or if it suits your accessibility needs, read the plain text version also below (Fig. 23). I am hopeful that the power of this mnemonic speaks for itself. The ACCESS-Solutions model infographic and the plain text version have been designed to make the practice of Geoaccessibility itself an accessible avenue for research at any level. I hope that future researchers and communities can continue to innovate within the Geoaccessibility framework using this model to address diverse accessibility needs and foster more inclusive environments. I fully believe that Geoaccessibility will contribute to the construction of healthy futures for everyone.

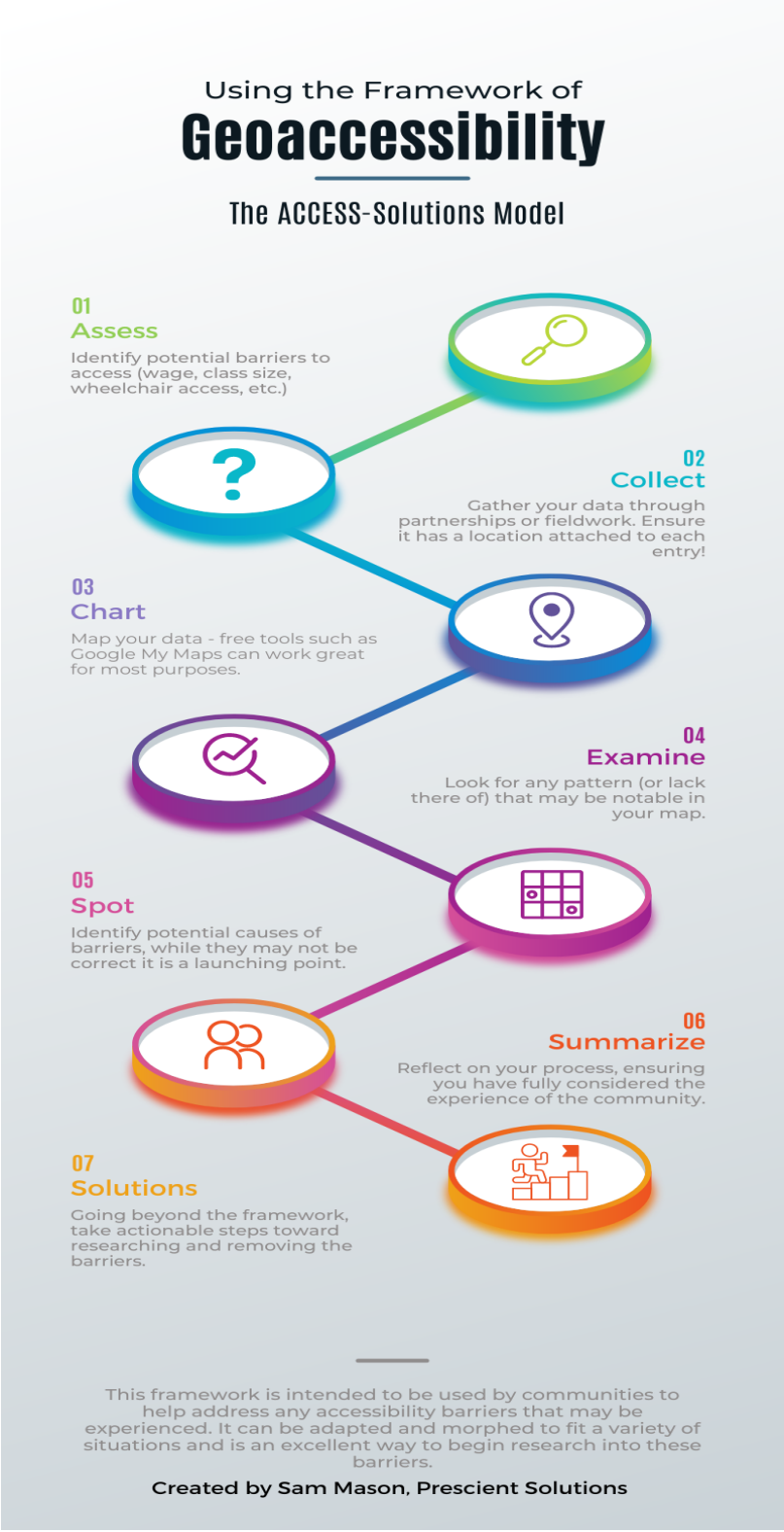

Figure 22 – Infographic of "The Framework of Geoaccessibility" created for community engagement. This infographic is designed to allow for community to easily utilize and apply the Geoaccessibility to any issues of access they may be experiencing.

Geoaccessibility Framework in Plain Text

In my commitment to make the paper accessible, I have also generated a plain text version of the infographic (Fig. 22).

Basic description:
Seven circles are laid out from the top to the bottom of the page with an icon in each numbered one through seven. To the side of each circle there is a text description explaining each of the steps in the Geoaccessibility framework.

#1 – Assess
Text: Identify potential barriers to access (wage, class size, wheelchair access, etc.)
Icon: Magnifying glass

#2 – Collect
Text: Gather your data through partnerships or fieldwork. Ensure it has a location attached to each entry!
Icon: Question mark

#3 – Chart
Text: Map your data - free tools such as Google My Maps can work great for most purposes.
Icon: Map pushpin

#4 – Examine
Text: Look for any pattern (or lack there of) that may be notable in your map.
Icon: Magnifying glass with trend line going through it.

#5 - Spot
Text: Identify potential causes of barriers, while they may not be correct it is a launching point.
Icon: 3x3 checkerboard with circles in some of the squares

#6 – Summarize
Text: Reflect on your process, ensuring you have fully considered the experience of the community.
Icon: Two people standing together

#7 – Solutions
Text: Going beyond the framework, take actionable steps toward researching and removing the barriers.
Icon: Character running up stairs to a flag

Situated at the bottom of the infographic is the following text:
This framework is intended to be used by communities to help address any accessibility barriers that may be experienced. It can be adapted and morphed to fit a variety of situations and is an excellent way to begin research into these barriers.

Figure 23 – A plain text version of *Figure 22*.

Chapter 5: Conclusion

The Geoaccessibility framework I have proposed in this study has the potential to drive innovation in accessibility solutions. By providing a detailed spatial analysis of accessibility features or barriers, it offers unique, impactful insights that allow community members to better understand and address gaps in service. Geoaccessibility is particularly powerful because it can repurpose existing accessibility data, giving it a new voice and increased functionality.

Mapping accessibility features and barriers helps communicate the impact of the work done by organizations such as STEPS Forward more effectively. This can help organizations secure funding by providing a more quantitative metric that is universally understood and easily grasped by all. By helping to securing additional funding and being recognized by more organizations, Geoaccessibility can be seen as a vehicle for positive change in the accessibility space more broadly. The application of Geoaccessibility techniques also works hand-in-hand with community engagement and empowerment. By making accessibility data more visible and understandable to the public, these techniques can raise awareness of accessibility issues and mobilize community action. For example, interactive maps such as the Mapping Student Diversity (Project 1) allow users to explore accessibility in areas they are interested in, which can help to build a sense of ownership and urgency around these issues. This increased public engagement helps to create a stronger, more informed community which can drive policy change and help to breakdown the barriers in place.

The integration of Geoaccessibility into accessibility research and practice represents a significant step towards healthier futures for everyone. By highlighting the spatial dimensions of accessibility, Geoaccessibility helps to give another voice to those impacted by accessibility barriers. The intersectionality between accessibility geographies, feminist geographies, and spatial analysis can reciprocally enrich their respective fields, and help to generate a more comprehensive and integrated understanding of social justice issues. Because of this specific intersectionality, geographers are uniquely positioned to use the Geoaccessibility framework lead the analysis of accessibility data and create new solutions that foster greater inclusion and equity for all individuals. For example, the particular case study of STEPS Forward projects, a population-corrected heatmap of high schools that students had attended can show which regions are more informed about inclusive post-secondary education, and which regions rely on the work of STEPS Forward more. Future research should continue to innovate within the Geoaccessibility framework to address diverse accessibility needs and foster more inclusive environments.

It is important to note that everyone experiences barriers to access in some way shape or form. Many folks experience these barriers through facets of identity such as race, gender, and disability, however the approach of Geoaccessibility aims to encompass all forms of “access” to a space, so the framework has been designed to be an all-encompassing way to identify and address these challenges. I have tried to demonstrate through my three projects with my community partner, STEPS Forward, how careful visualization of data can immediately lead to the next logical series of research questions to be explored in the pursuit of a more accessible society. This case study is ultimately an example of how Geoaccessibility can be applied to the context of any particular accessibility initiative, organization, or advocacy group.

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Appendices

Appendix A: STEPS Forward Survey Questions

List of all questions asked in the STEPS Forward Survey:

1) Which high school did you attend?
2) Which college or university did you attend?
3) What year did you graduate?
4) How did you learn about STEPS Forward? (guidance councillor, teacher, family, etc.)
5) Are you working? (Yes or No)
6) If yes, please rate how happy you are with your job on a scale from 1-10 (factors to consider include: accessibility, environment, management/staff)
7) Do you feel you are fairly paid for your work? (Yes or No, with option to elaborate)
8) Does your work connect to what you studies?
9) When in college/university, who did you make connections with? (Choose all that apply from the following list: other students, professors, student services, clubs, inclusion facilitators, employer, coworkers, or other?)
10) Are you still in contact with anyone from college/university
11) Did your post-secondary education help you move closer to your goals?
12) How are you supported to be included in your community and/or at work?
13) If you would like to add anything else, please do so here:

Appendix B: STEPS Forward Newsletter

Mapping Inclusive Post-secondary Education Accross BC

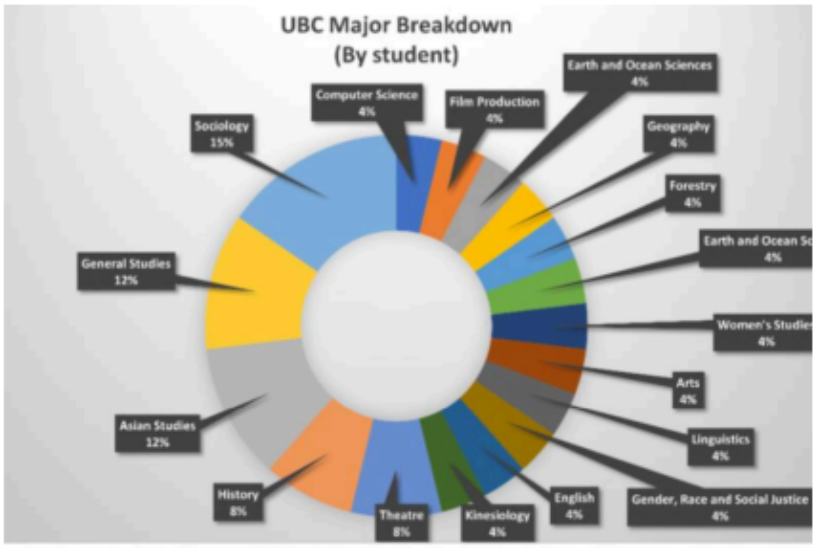
Sam Mason, *UVic Honours Student, Department of Human Geography*

Sam is going into the final semester of his undergraduate degree, he is specializing in mapping and inclusivity geographies at UVIC. When not studying, he likes to play the piano, ride his bike, and draw on his computer. Sam grew up moving around Canada but spent a large portion of his childhood on Secwépemc territory in Salmon Arm.

I am thrilled to share with you the exciting work I have been involved in through a directed study with Professor Teresa Dawson, in the Department of Geography at the University of Victoria, and STEPS Forward.

In this directed study, I focused on creating a comprehensive map that highlights the diversity of scholarly interests among students pursuing an inclusive post-secondary education with the support of STEPS Forward initiative partnerships across British Columbia. The primary goal I had in mind while creating the map was to break down harmful stereotypes, particularly those surrounding the capabilities of individuals with intellectual disabilities.

To give some context about the map, each point represents a post secondary institution that provides inclusive post-secondary education, complete with relevant data such as the date each institution began their partnership with STEPS, alumni count, current student numbers, and detailed breakdowns of courses and majors that students have and are taking through each initiative. This map serves as a comprehensive resource to help STEPS Forward showcase the growth and implementation of inclusive education initiatives across the province. This powerful visual tool can also help to elicit policy change when engaging with post-secondary institutions or governmental organizations. Lastly, the map can provide valuable insights into the faculties or majors that may have barriers for students with complex disabilities pursuing inclusive education. Conversely, it also offers a glimpse into which faculties can be considered positive examples of inclusivity.



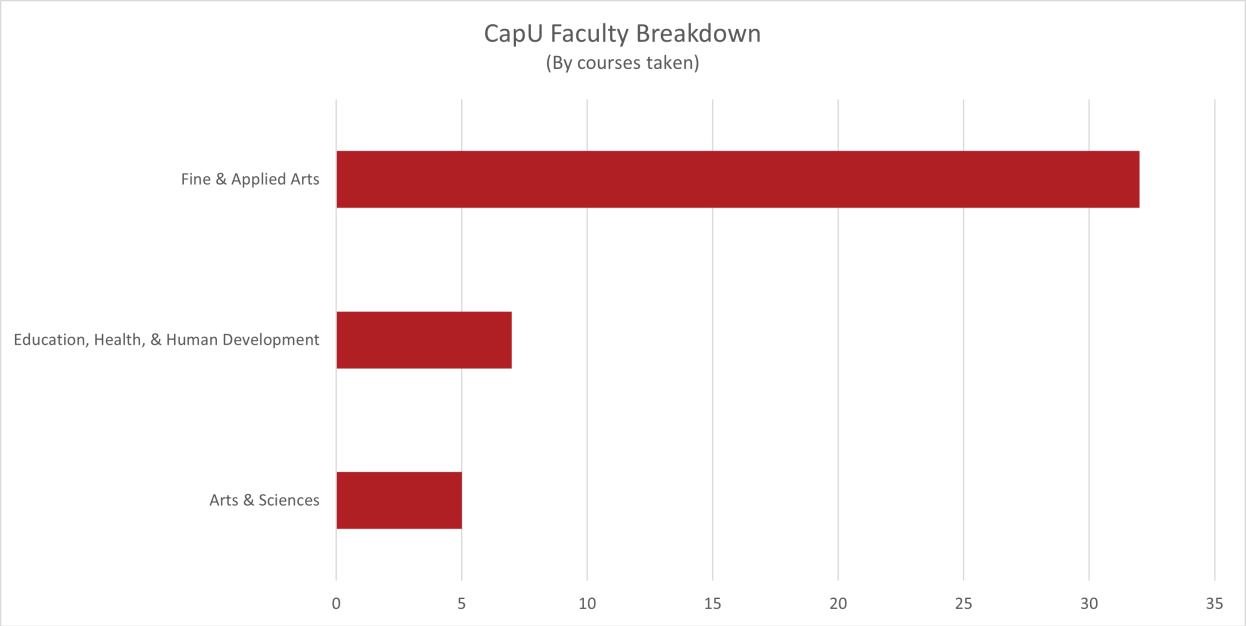
As seen in Figure 1, one of the many graphs included in the map, the breakdown of student majors is incredibly diverse at the University of British Columbia (UBC). Majors with more students may allude to that faculty being a gold standard, or it could simply just be the unique interests of students. The lack of that faculty being a gold standard, or it could simply just be the unique interests of students. The lack of any trend in this case creates a noteworthy trend in and of itself; that trend being that students with intellectual disability can, and should be able to pick any academic stream they are interested in.

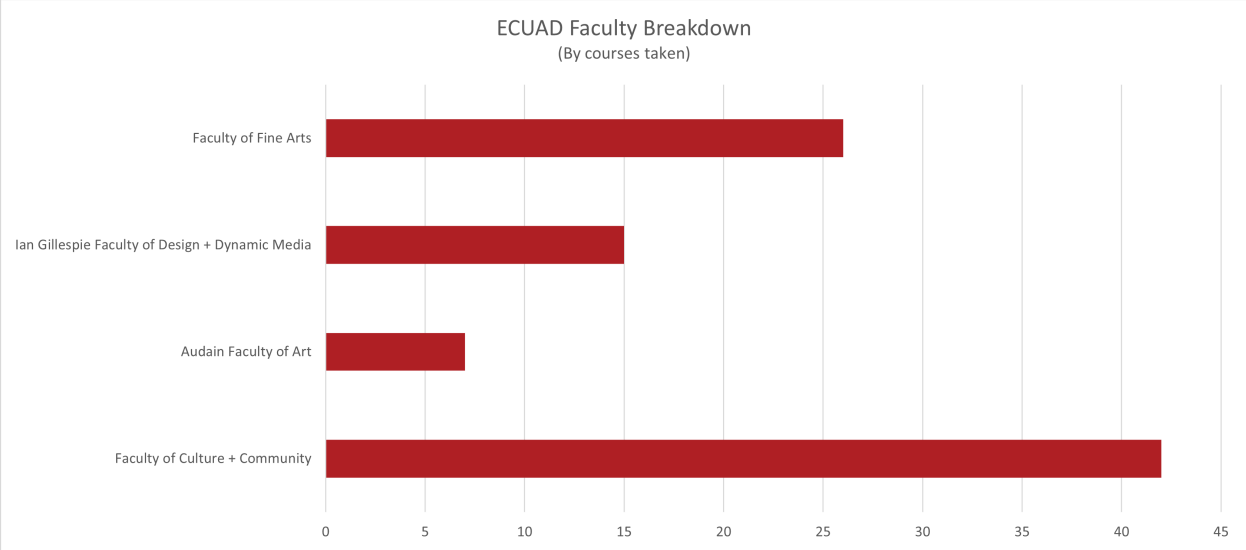
While creating this map, I initially struggled to find a fitting name. However, as I was creating the graphs and looking for trends in the data, it became evident that this was a story of student diversity more than anything else. I believe that this map showcases the incredible academic subject diversity and capability of students with intellectual or complex disabilities. These maps are more than geographical representations; they are powerful forms of communication that tell a story, exemplify trends, and help with strategic planning for the future. I believe that there is so much room for expansion and innovation in the inclusive education space, and that this map is an essential step in that journey. It has been incredibly exciting and an honour to contribute my small part in the expansion of the inclusivity movement.

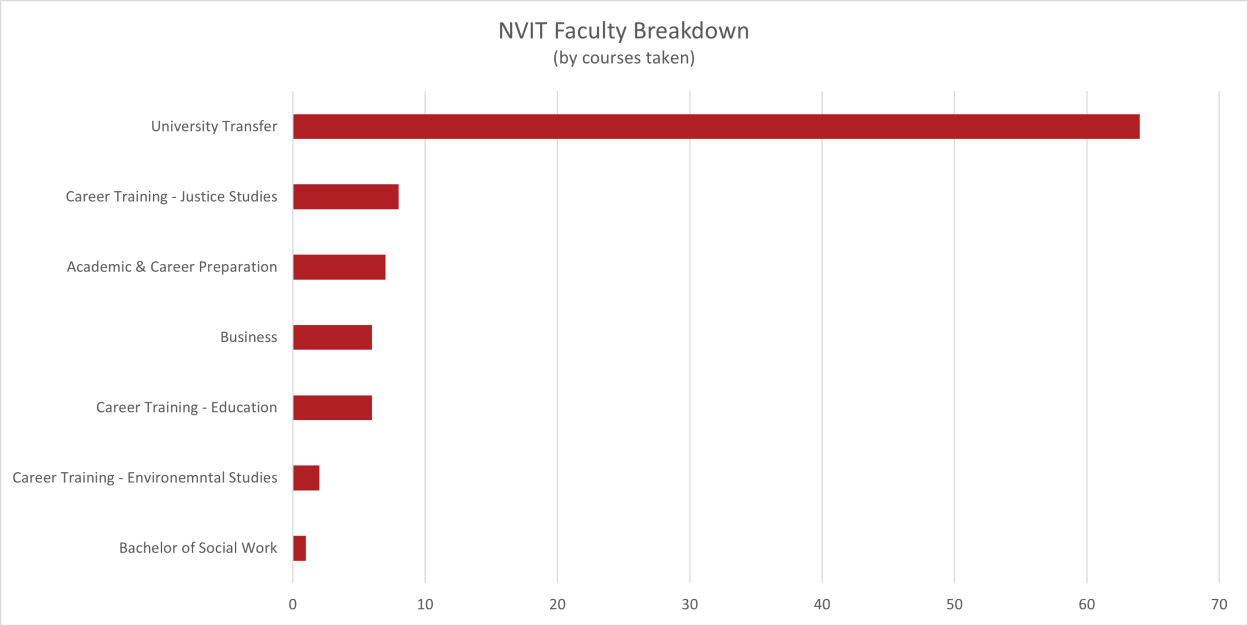
(STEPS Forward, 2024, p.8-9)

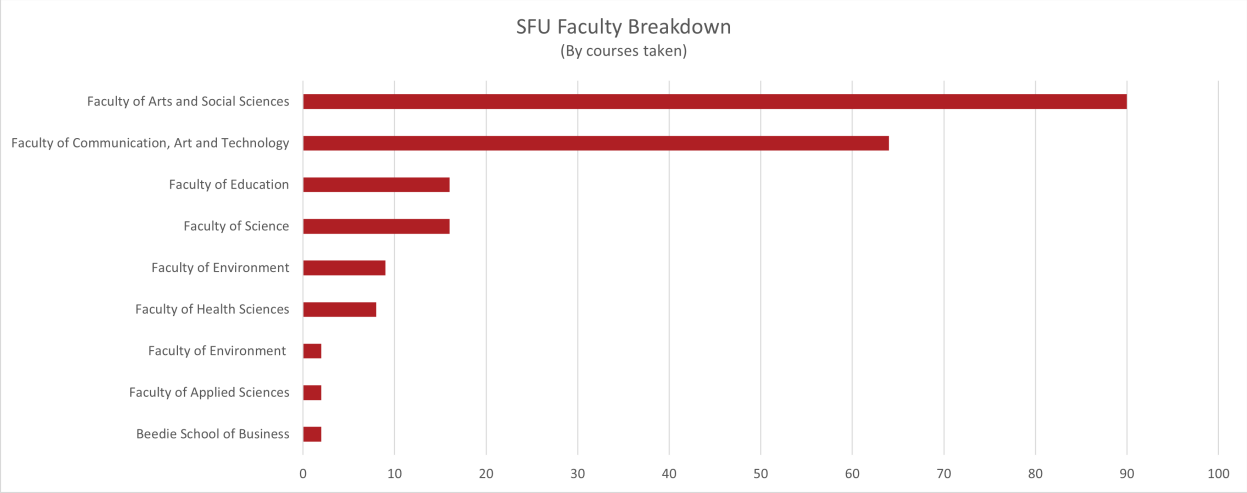
Appendix C: STEPS Forward Web Map Graphs

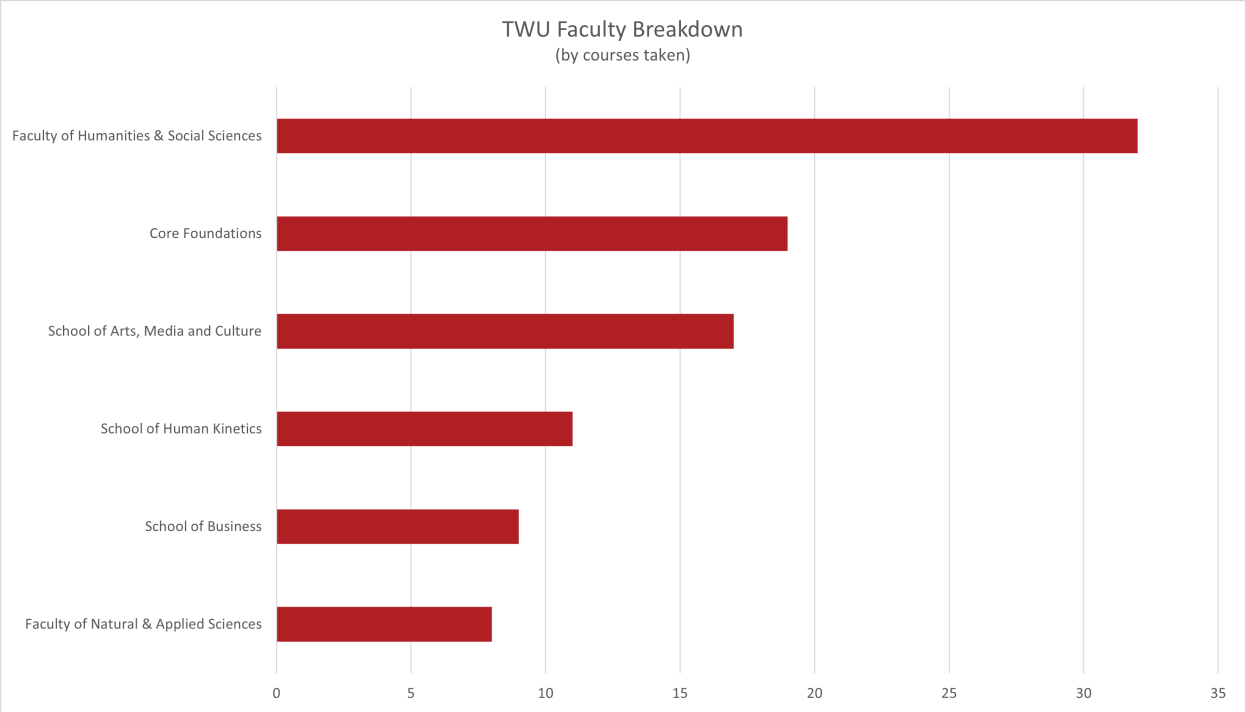
C1. Bar Graphs (Individual courses taken in each faculty by STEPS Forward supported students at BC Institutions)

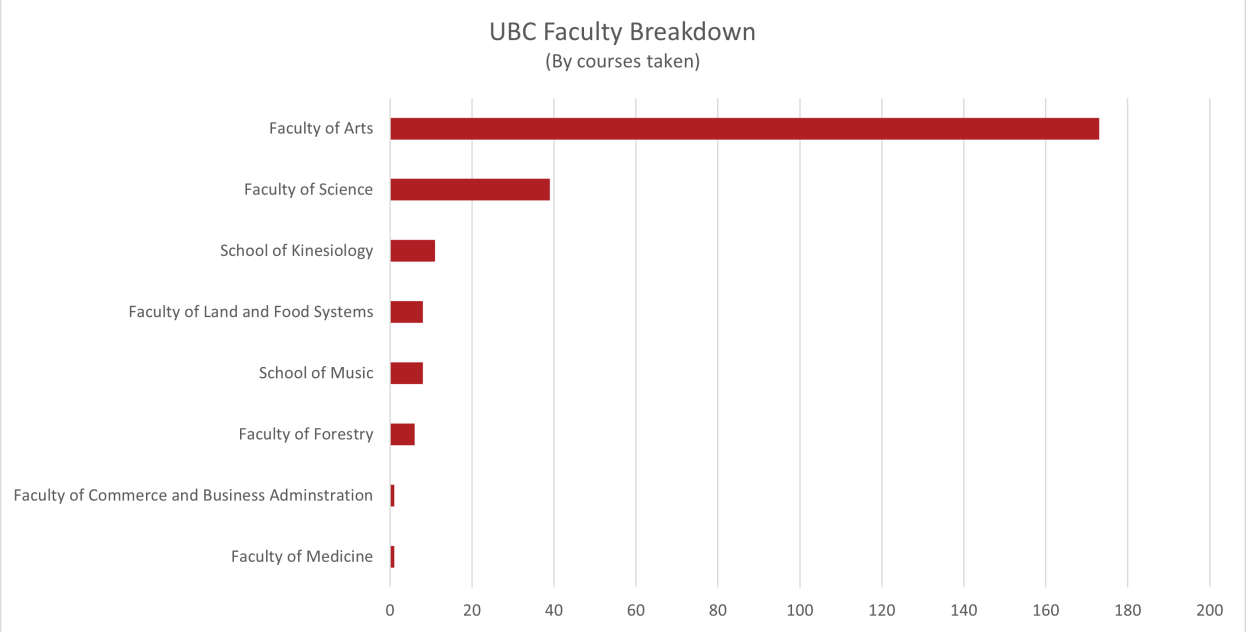


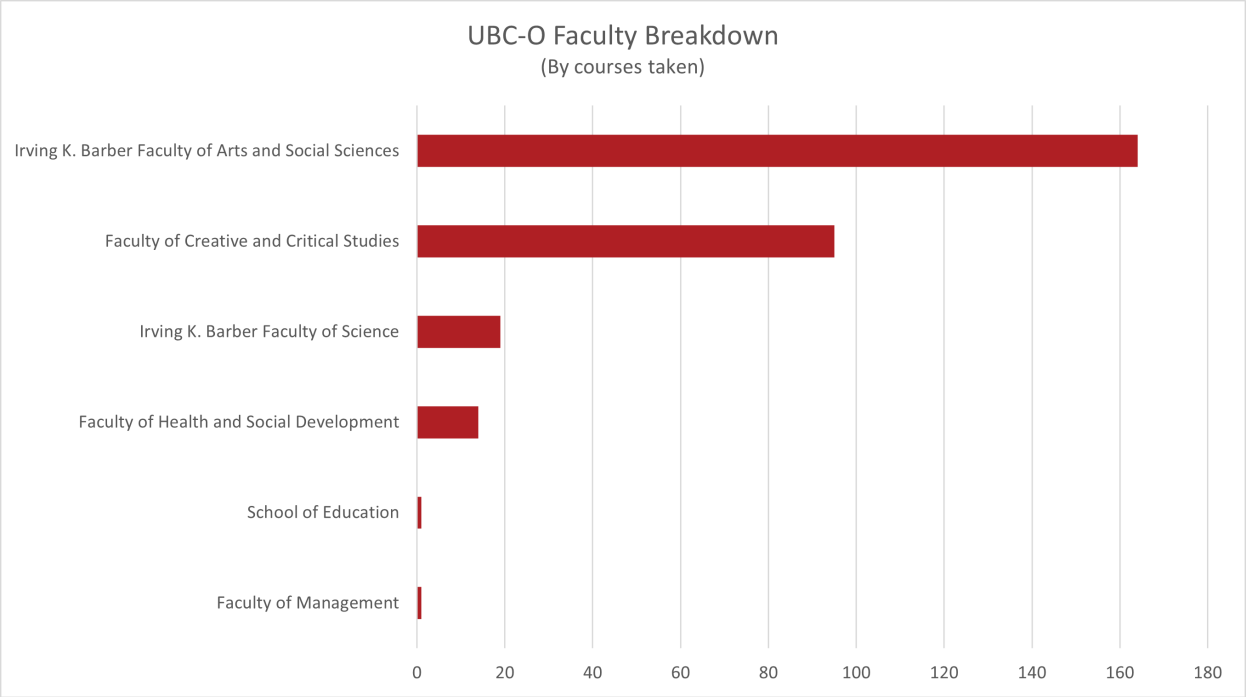


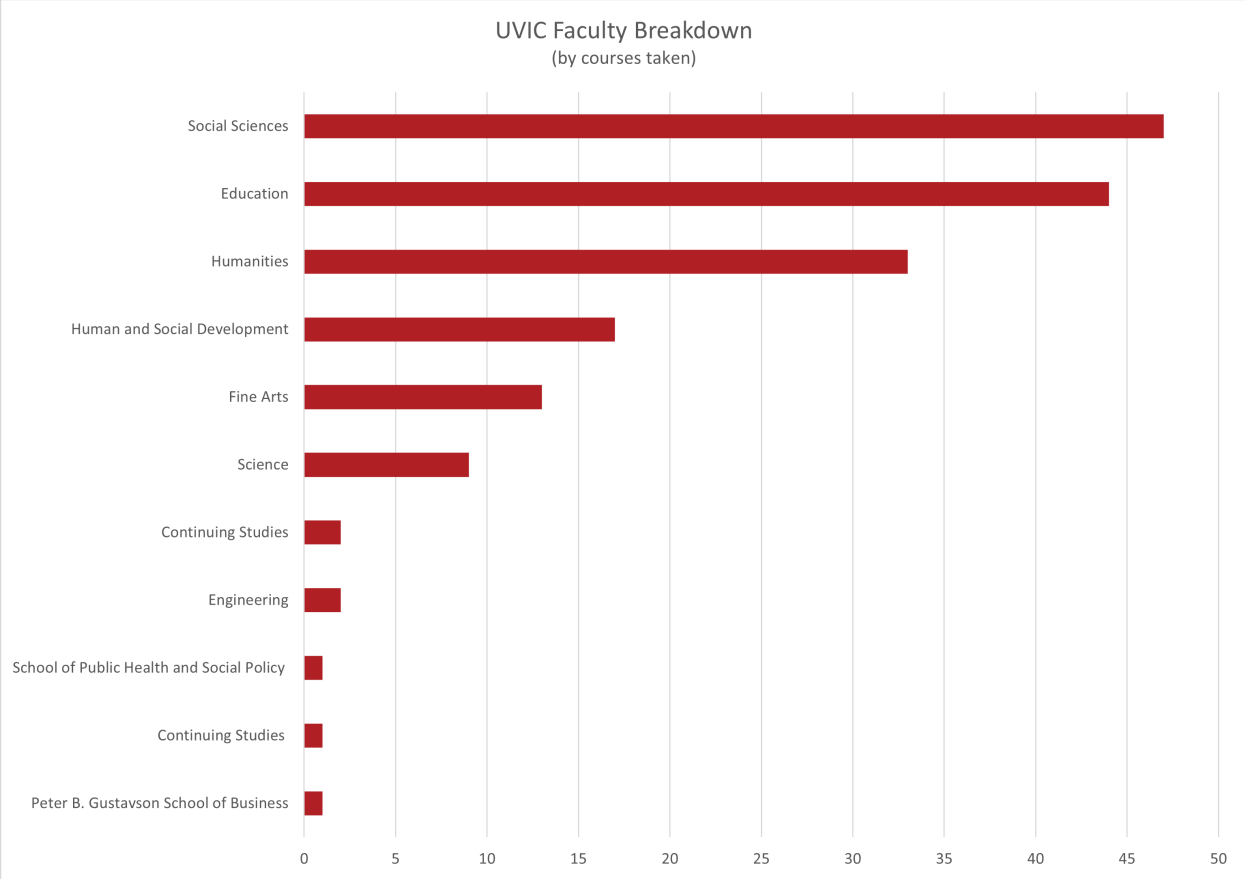

NVIT Faculty Breakdown
(by courses taken)
University Transfer
Career Training - Justice Studies
Academic & Career Preparation
Business
Career Training - Education
Career Training - Environemntal Studies
Bachelor of Social Work
0
10
20
30
40
50
60
70


SFU Faculty Breakdown
(By courses taken)
Faculty of Arts and Social Sciences
Faculty of Communication, Art and Technology
Faculty of Education
Faculty of Science
Faculty of Environment
Faculty of Health Sciences
Faculty of Environment
Faculty of Applied Sciences
Beedie School of Business
0
10
20
30
40
50
60
70
80
90
100


TWU Faculty Breakdown
(by courses taken)
Faculty of Humanities & Social Sciences
Core Foundations
School of Arts, Media and Culture
School of Human Kinetics
School of Business
Faculty of Natural & Applied Sciences
0
5
10
15
20
25
30
35


UBC Faculty Breakdown
(By courses taken)
Faculty of Arts
Faculty of Science
School of Kinesiology
Faculty of Land and Food Systems
School of Music
Faculty of Forestry
Faculty of Commerce and Business Adminstration
Faculty of Medicine
0
20
40
60
80
100
120
140
160
180
200


UBC-O Faculty Breakdown
(By courses taken)
Irving K. Barber Faculty of Arts and Social Sciences
Faculty of Creative and Critical Studies
Irving K. Barber Faculty of Science
Faculty of Health and Social Development
School of Education
Faculty of Management
0
20
40
60
80
100
120
140
160
180


UVIC Faculty Breakdown
(by courses taken)
Social Sciences
Education
Humanities
Human and Social Development
Fine Arts
Science
Continuing Studies
Engineering
School of Public Health and Social Policy
Continuing Studies
Peter B. Gustavson School of Business
0
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20
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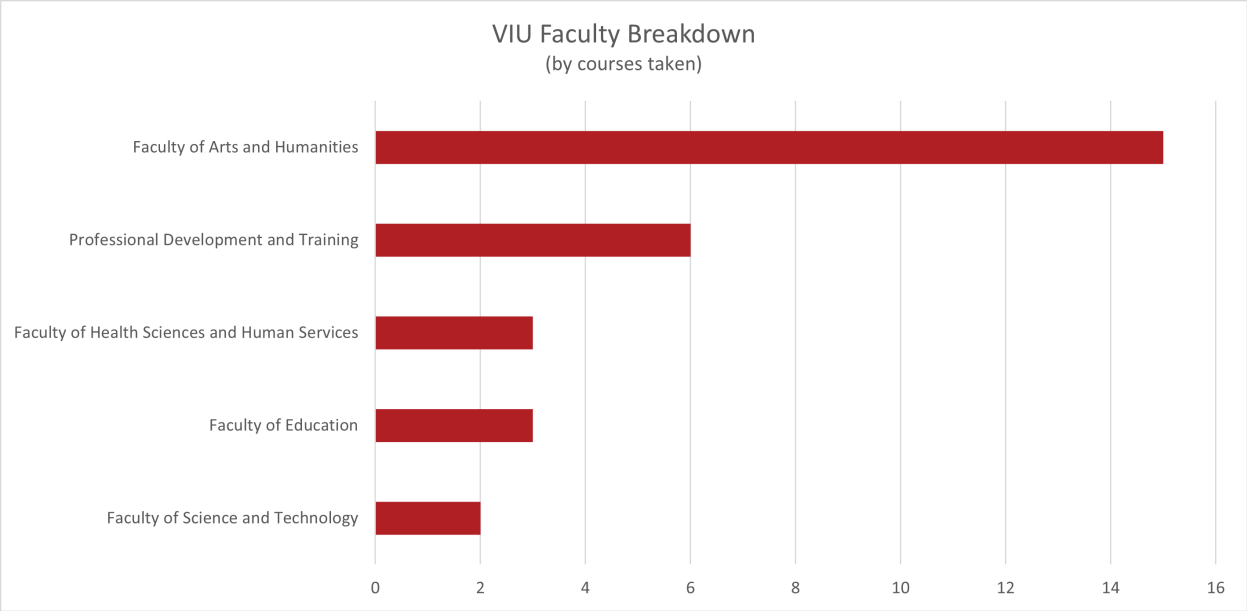
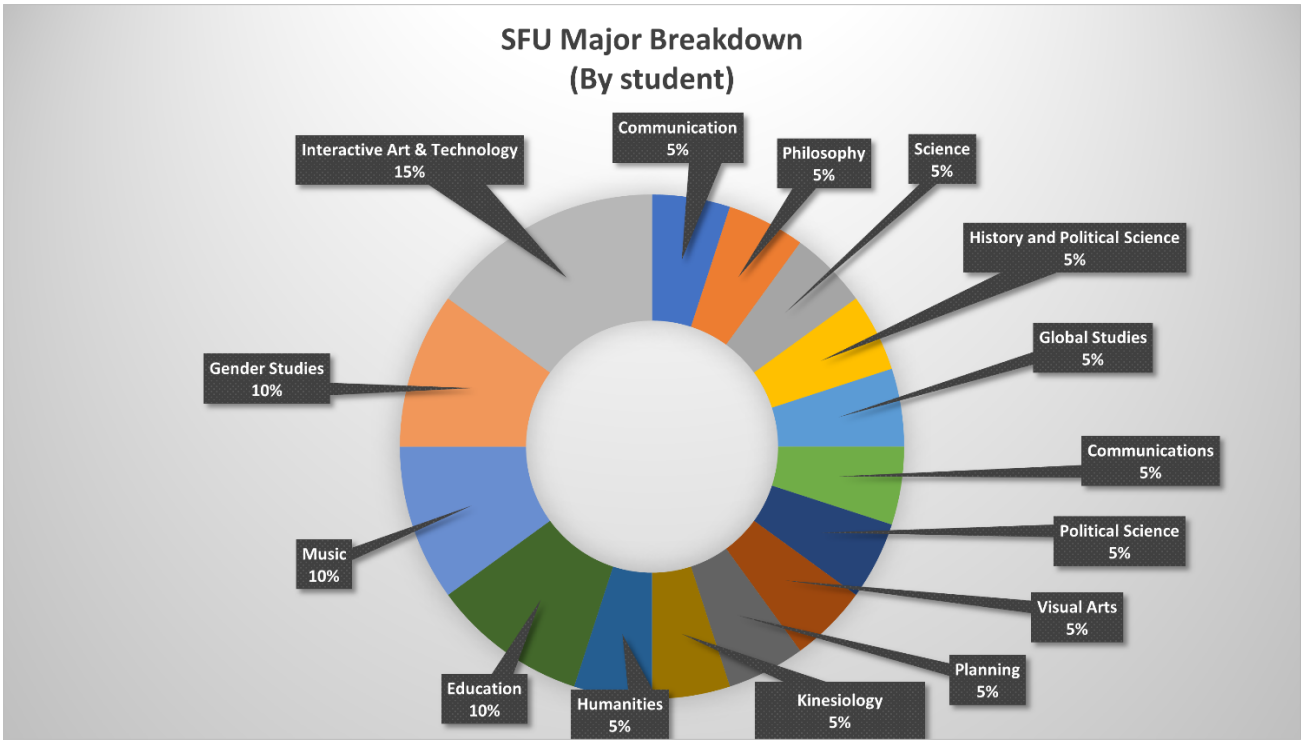
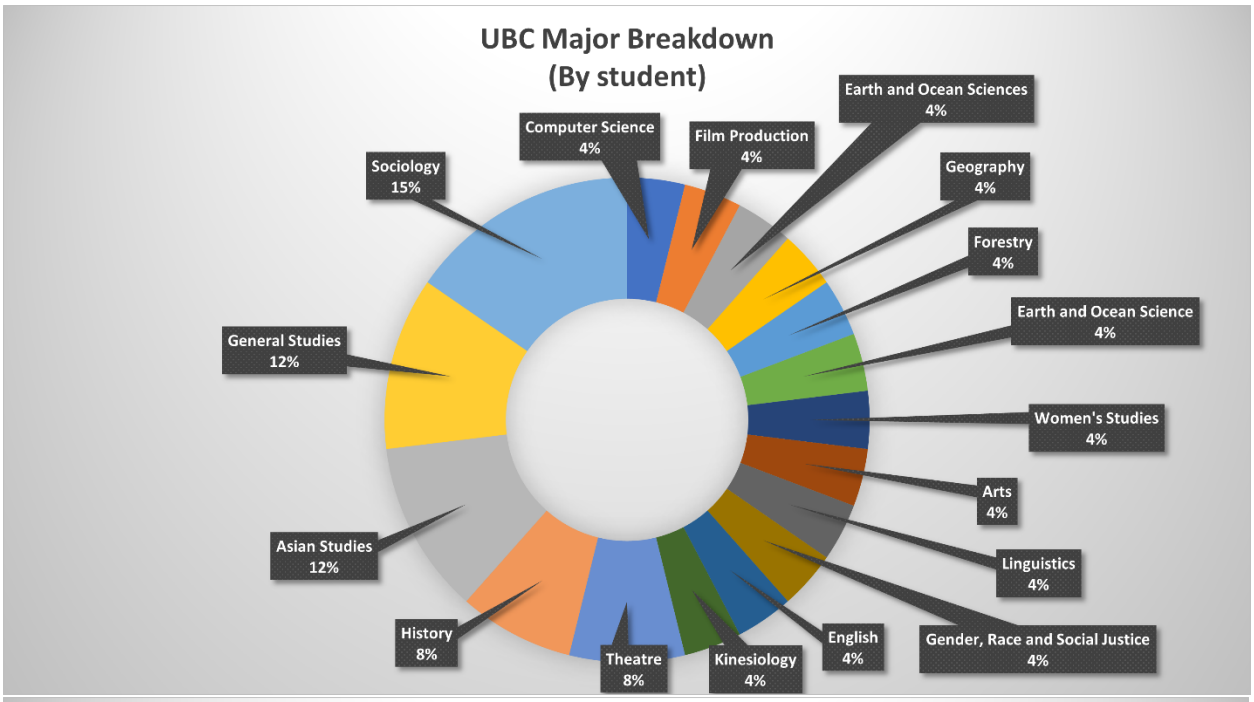
45
50

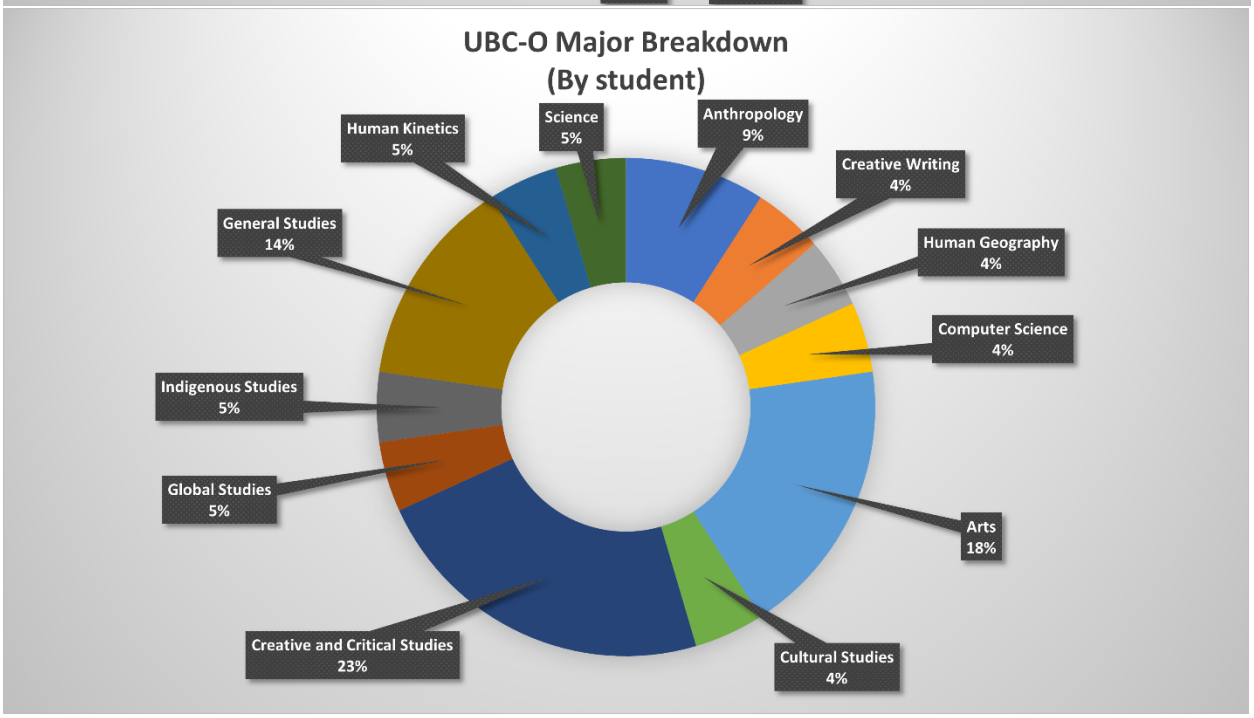


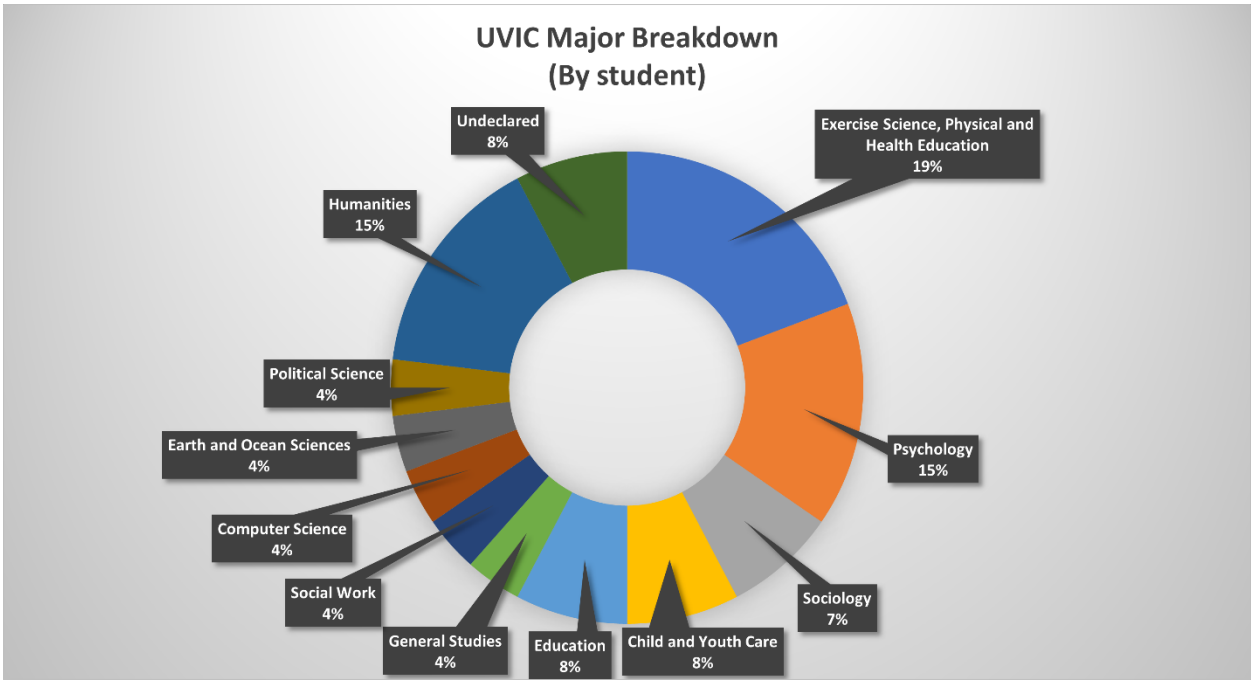
Graphs for CNC and College of the Rockies were not generated due to a lack of data as they are recent partners.

C2. Pie Graphs (Declared majors of STEPS Forward supported students)




UBC Major Breakdown
(By student)
Earth and Ocean Sciences 4%
Computer Science 4%
Film Production 4%
Sociology 15%
Geography 4%
Forestry 4%
Earth and Ocean Science 4%
General Studies 12%
Women's Studies 4%
Arts 4%
Asian Studies 12%
Linguistics 4%
History 8%
English 4%
Gender, Race and Social Justice 4%
Theatre 8%
Kinesiology 4%


UBC-O Major Breakdown
(By student)
Human Kinetics 5%
Science 5%
Anthropology 9%
Creative Writing 4%
General Studies 14%
Human Geography 4%
Computer Science 4%
Indigenous Studies 5%
Global Studies 5%
Arts 18%
Creative and Critical Studies 23%
Cultural Studies 4%


UVIC Major Breakdown
(By student)
Undeclared 8%
Exercise Science, Physical and Health Education 19%
Humanities 15%
Political Science 4%
Psychology 15%
Earth and Ocean Sciences 4%
Computer Science 4%
Sociology 7%
Social Work 4%
General Studies 4%
Education 8%
Child and Youth Care 8%