

# **Neurodiversity and Extended Reality: Community Growth Through Virtual Worlds**

A Thesis

Presented in Partial Fulfillment of the Requirements for the

Degree of Master of Science

with a

Major in Integrated Architecture and Design

in the

College of Graduate Studies

University of Idaho

by

Julio A. Gonzalez

Approved by:

Major Professor: John W. Anderson, M.S. Architecture.

Committee Members: Dr. Roger Lew, Ph.D; Dr. Sarah A. Bush, Ph.D.

Department Administrator: Bruce Haglund, M. Arch.

May 2022

## Abstract

When I started working with the Autism Mixed Reality Institute (AXRI) I wanted to find and create opportunities for young adults to develop individual skills that would contribute to improving their quality of life. I found that, like myself, individuals who have Attention Deficit Hyperactive Disorder (ADHD) share a common community identity with individuals with Autism. This encouraged me to explore what organizations are doing to engage with neurodiverse community capital growth. The community capitals framework is typically applied to analyzing the seven areas of social value in a geographic community. This helps identify gap and growth areas in social infrastructure. If the framework were to be applied to a virtually connected community via interactive virtual environments, then community driven solutions would have higher probability of growing, sustaining, and thriving.

By establishing the foundational social infrastructure that has led-to and developed meaningful community growth, leaders in immersive technology and mental health advocacy at the Autism Mixed Reality Institute (AXRI) are driven to focus on adapting service models for the Autism community in Idaho and the wider Neurodiverse community. Extended reality (XR) technology that emphasizes the value in visual learning and high user engagement can lead to developing community growth across the internet; From encouraging Idaho communities through the Sarel's Place Art Gallery to Neurodivergent and Indigenous community members sharing their stories on a web-based immersive platform. Web-based meeting platforms like Spatial.io are allowing communities to develop virtually built capital. Through collaboration, advocacy, and accountability AXRI is developing the tools necessary to develop sustainable social infrastructure on extended reality platforms. Through advocacy we gain perspective, through accountability we can hold others and ourselves to the standards of human equality. With the guidance from community members, specialists, mentors, peers, advisors, community leaders will continue connecting people with people by combining virtual technology with necessary social infrastructure to meet the challenges of today.

## **Acknowledgments**

Thank you: To Kathleen Cohen, who has been an admirable role-model, friend, and shepherd in the Immersive XR Industry. Ron Oberleitner, a meaningful advisor and coach toward my work with AXRI collaborations. John Anderson, an honorable mentor and colleague in my journey through academia and beyond. Dr. Roger Lew, for his integral guidance and understanding with communication. Dr. Sarah Bush, for her facilitation and dedication to ethical community leadership and growth.

### **Dedication**

The completion of this work is dedicated to my mother; who by example, has inspired me to never stop believing in myself.

## Table of Contents:

Abstract.....	ii
Acknowledgements.....	iii
Dedication.....	iv
Table of Contents.....	v
List of Tables.....	vi
List of Figures.....	vii
Chapter 1: Neurodiversity, Autism, and Disabilities Representation in Idaho.....	1
Chapter 2: AXRI (Autism Mixed Reality Institute).....	10
Service Model .....	12
Chapter 3: Community Capital Methodology and Engagement.....	16
Community Capitals Synthesis.....	19
Chapter 4: Conclusion.....	30
Work Cited.....	32

## **List of Tables**

1.1 University of Warwick visual learning study configuration.....	7
1.2 Floreo outlet for engagement, analysis, and methods.....	8
2.1 AXRI Leadership Organizational Chart.....	11
2.2 AXRI Service Model.....	12
2.3 AXRI Initial Strategy.....	13
3.1 The 7 Community Capitals.....	17

## List of Figures

1.1 Percentage of adults in the state of Idaho with disabilities.....	3
1.2 Percentage of adults with select disability types.....	3
1.3 CDHD 2019 Annual Progress Goal 3.....	5
1.4 CDHD 2019 Annual Progress Goal 1.....	6
2.1 AXRI Core Principals.....	12
2.2 AXRI/VTL Lab Boise Campus Space.....	14
3.1 BlueCross VR Accessibility Plugin Tool.....	20
3.2 AXRI + Idaho Voc. Rehab + McDonald’s.....	23
3.3 Surel’s Place Art Residency Collaboration.....	24
3.4 Indigenous LINK XR storytelling space developed on Spatial.io.....	25
3.5 XR Neurodiversity Workshop.....	26

## **Chapter 1: Neurodiversity, Autism, and Disabilities Representation in Idaho**

Originally defined by Australian sociologist Judy Singer, Neurodiversity (2017) is the ideological perspective that explores and accepts the limitless neurological variations among all people. More specifically, the original intended use of the term is to advocate for the common interests of various neurological minorities (Singer, 2021). Both accounting from Singer's personal journey and Houting's analysis of more recent analysis Neurodiversity, the movement has primarily been comprised of individuals with autism and neurodivergent advocates and activists. Adding that as the movement's community gains traction, we can start to point to positive changes and educating more of the neurotypical society; regarding Neurodiversity as a social justice movement and paradigm shift for cognitive inclusion. Concluding that strengths-based approaches to strategy management and development for the community are widely accepted as best practice. Commonly discussed regarding Neurodiversity, (den Houting, 2018) are the vital challenges the Autism community faces from departing from neurotypical society "fixing" a person with Autism and more towards realigning the focus towards how to best equip the individual for their specific needs.

The Disability:IN non-profit initiative, (Disability:IN, 2022) works with partners around the world to identify user groups for allocating resources to community organizations. With ties leading back to the American Disabilities Act of 1990, and the Office of Disability Employment (ODE), the non-profit seeks to include people with all types of disabilities. One of the most prominent groups among the population identified, are individuals in the Autism community. Autism, also referred to as Autism Spectrum Disorder (ASD), can affect the way an individual associates with other people as well as their environment; (deGiere, 2020) This can also be seen as repetitive behaviors, attention deficits, or causing disengagement. In turn, this has the potential of affecting behavior and learning. Because learning and education is so standardized these types of actions require alternative learning strategies. The way neurotypical society views repetitive actions, lack of eye contact, or uncommon social behaviors is a larger issue that relies heavily on meaningful Neurodiversity education, awareness, and advocacy. With these types of social irregularities however, (Virginia Department of Education 2011) it can be increasingly difficult to match the obligations of



neurotypical life. How neurotypical society comprehends individuals with Autism and the wider Neurodiverse community must be realigned towards a better understanding and acceptance of diversity and disabilities as a whole. Encompassing the necessity for societal comprehensive understanding of neurological diversity (Doyle, 2020) ranging from various mental disorders, syndromes, cognitive variations, and conditions. Regarding each case as a specific and unique adaptable solution to the individual. Some challenges may rely on establishments adjusting the architecture or user-experience of a space to accommodate the needs of an individual, some instances may ask of the individual to focus more on how the individual can best verbalize their needs. Having a core understanding and perspective for anyone who thinks differently, allows people to relate to one another to find the alternative means for communication.

Societal Autism awareness and understanding the complexities of Neurodiversity, (Dempsey, 2020) are consistent necessities for individuals who are more severely affected by living with autism in housing and/or assisted living. The Autism Self Advocacy Network or ASAN, has continued to progress efforts in changing housing policy to avoid intellectual segregation of people among the Neurodiverse community, more specifically the autism community. Individuals not only have difficulty establishing housing due to necessary assistance but are given a separate community to live in with other people in their same “intellectual bracket”. This perpetuates the separation of typical from atypical living, Singer states that because we are all neurodiverse, (Singer, 2017) and that no two humans are the same, we should not use neurodiversity advocacy and awareness as a divider. The goal is for society to make strides at accepting minority groups without segregating, tokenizing, or misrepresenting. In March of 2020, (Dempsey, 2020 Notation.33) ASAN motioned to enact housing policies to match the needs of racial, social, and economic segregation.

Generalized disability assessment is an outlet for how progress and services are made to the disability’s population. Although the collection of disciplines that demand a workforce to assess and serve individuals with special needs will remain persistent. (ODE, 2021) In Idaho the minimum starting age of employment is 14, after the age of 18 individuals with disabilities risk losing financial and social support systems for seeking employment opportunities and career development. An annual study by the Office of Disability

Employment (ODE) Policy shows the rate at which individuals with disabilities are joining the workforce is increasing. In response to this type of progression, the office is working towards wider-reaching initiatives to establish a better understanding and infrastructure to addressing the needs of the population with disabilities. One of these initiatives is the PEATworks (*The Partnership on Employment & Accessible Technology*) program, (PEAT 2022) seeking to provide internet access, coaching, and training to remote workers with disabilities and their employers. In the state of Idaho (CDC, 2020) [Figure 1.1] 23.1% of citizens have varied types of disability requiring some level/degree of external assistance. More specifically, (2017 Behavioral Risk Factor Surveillance System (BRFSS) [Figure 1.2] adults with external needs can be assessed through the measurement of the population of both the country and the state of Idaho.

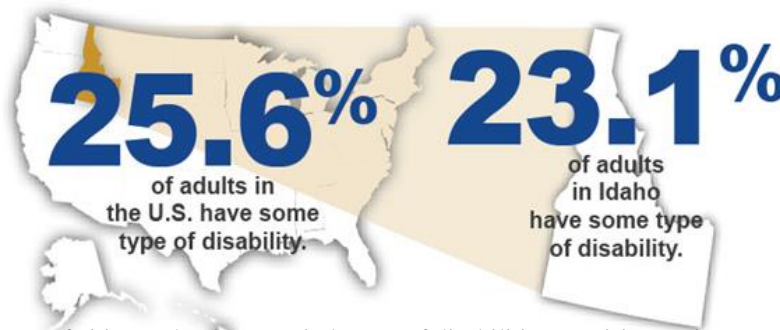


Figure 1.1 Percentage of citizens that have varied types of disabilities requiring assistance, Nationwide and in the state of Idaho. (CDC, 2020)

Percentage of adults with select functional disability types: \*

Types of disabilities comparing U.S. with Idaho

	U.S.	Idaho
Mobility: Serious difficulty walking or climbing stairs.	12.9%	10.8%
Cognition: Serious difficulty concentrating, remembering, or making decisions.	11.4%	9.5%
Independent living: Difficulty doing errands alone, such as visiting a doctor's office or shopping.	7.0%	5.1%
Hearing: Deafness or serious difficulty hearing.	5.6%	6.1%
Vision: Blind or serious difficulty seeing, even when wearing glasses.	4.7%	3.4%
Self-care: Difficulty dressing or bathing.	3.8%	2.7%

Figure 1.2 A more specific observation of the percentage of citizens that have varied types of disabilities requiring assistance, Nationwide and in the state of Idaho. (CDC, 2020)

Support systems can be costly and rely heavily on the individual, their family, or insurance provider if applicable. Insurance providers hold a substantial amount of power in this process, that without proper defining of each type of behavioral treatment, solution, or strategy some of these support systems have in the past not been covered. Thankfully, (Fodor, 2019) in 2018 Idaho legislation acknowledged several forms of treatment and services to be available for a collection of insurance plans. In 2014, (Idaho State Legislature 2014) the Idaho state legislature enacted a statute: Title 39 -Chapter 31- Section 39-3124. Which called for key community members to be a part of the behavioral health community to seek and assess means to inform state representatives of key issues in behavioral health.

In the annual report from The Center on Disabilities and Human Development (CDHD) for 2019: (Fodor, 2019, p.2)

The support provided by CDHD Community Advocacy Coordinator, Richelle Tierney, along with State partners Ron and Sharon Oberleitner, owners of a private technology company, (Behavior Imaging) to the Idahoans for Autism Insurance Reform group. The outcome of this joint effort was the passage of a state rule requiring all insurance companies to cover evidence-based behavioral development treatments for Autism, making Idaho the 47th state to require such coverage.

Data following this progress in the report found (Fodor, 2019, p.2) [Figure 1.3] that objectives meet the goals for providing representation for individuals from underrepresented communities, and by providing vital training criteria for Autism insurance providers that were fully met under state funded advocacy and educational services.

<b>GOAL 3.</b> Impact policy through research, dissemination, and engagement with coalitions related to the expressed needs of state constituents and underserved populations		
<b>Core Function:</b> Community Services: Training and Technical Assistance, Research or Evaluation, Product Development and Dissemination		
<b>Areas of Emphasis:</b> Education and Early Intervention, Child Care, Health, Employment, Quality Assurance, Other-Assistive Technology and Recreation		
<b>Type of Activity:</b> Systemic Change, Advocacy		
Objectives (Annual Measures)	Major Accomplishments	FY 2019 Annual Progress
<b>Objective 3.1.</b> In collaboration with the DD Council and Disability Rights Idaho, organize, support, and empower families, youth and adults with developmental disabilities to become effective advocates in public policy by building a policy coalition in at least one community annually.	<ul style="list-style-type: none"> <li>The Policy Coalition conducted <b>7 policy trainings in 4</b> new communities to <b>431 participants</b>. The new communities include Twin Falls, Boise, Nampa, and Moscow. Trainings included presentations on home and community-based services and the impact that block grants, cuts, and state flexibility have on Medicaid services; a presentation on Idaho Prop 2 and the impact on the disability community; and, Blessings of Liberty screenings and panel discussions.</li> <li>The CDHD provided technical assistance to coalition members in marketing and dissemination strategies.</li> <li>Provided TA for Idahoans for Autism Insurance Reform</li> <li>CDHD provided TA for ILW workgroups</li> </ul>	<input checked="" type="checkbox"/> Fully achieved <input type="checkbox"/> Partially <input type="checkbox"/> Not initiated

**Goal 3: Broaden Impact on Policy & Research**

**OUTPUTS** (our activities; what we have accomplished)

Objectives	Annual Target	Year-End Data	Status
3.1 Policy coalition	1 community each year	4 communities in FY19	✓!
3.2 Committees	20 committees	11 national 19 state 7 university 12 project/local	✓!
3.3 Research/evaluation	Up to 5 projects	7 research projects	✓!
3.4 Dissemination	80% of products in accessible formats	71% (72/101 products)	👁️

**OUTCOMES** (our achievements; the results of our activities)

Who	What	Annual Target	Year-End Data	Status
Community members	Increased awareness of how to advocate for & participate in community services/policies	90%	None reporting	👁️
Sustained TA recipients	Satisfaction with services received	80%	94% (88% response, 35/40)	✓!
Sustained TA recipients	Enhanced resources/services, or Strengthened community networking, or Increased identification of policy changes needed	80%	88% (89% response, 42/47)	✓
Website users	Satisfaction with content on CDHD website	80%	95% (35% response, 59/171)	✓!

Status: ✓! Exceeded    ✓ Completed    👁️ Needs Review

Figure 1.3 First, the third goal set by the CDHD for new disability policy training modules. Second, more specific status report of Goal 3 objectives. (Fodor, 2019, p.24)

By improving technical advocacy and support networks from the CDHD in the State, the CDHD can continue to allocate resources, workforce, and equipment to necessary providers of the community to fulfill the then partial progress found in Objective 1.1. (Fodor, 2014, p.4) [Figure 1.4]

<b>GOAL 1.</b> Enhance university-based education across disciplines on diversity, integration, human rights, accessibility, evidenced based practices, policy and leadership		
<b>Core Function:</b> Interdisciplinary Pre-service Preparation and Continuing Education		
<b>Areas of Emphasis:</b> Education and Early Intervention, Child Care, Health, Employment, Quality Assurance, Other-Assistive Technology and Recreation		
<b>Type of Activity:</b> Capacity Building		
<b>Objectives (Annual Measures)</b>	<b>Major Accomplishments</b>	<b>FY 2019 Annual Progress</b>
<b>Objective 1.1.</b> To increase the number of students from minority or underrepresented groups, recruit <b>up to five students annually</b> from diverse backgrounds to participate in undergraduate and graduate programs offered through the CDHD and URLEND.	The CDHD's undergraduate interdisciplinary preservice trainee program (ITP) recruits students from all University of Idaho (UI) majors/colleges. Students are recruited by hosting tables at various information fairs and informally through word of mouth. A total of <b>13 students</b> participated in the ITP program from Business, Psychology, Child and Youth Development, Human Development and Education. In addition to paid work through various projects, student trainees attend group trainings, engage in student led projects and participate in field trips designed to further their exposure to disability policy, related disciplines, principles of human rights, diversity, and self-advocacy. To that end, students attended <b>five group training</b> events that addressed self-advocacy, abuse/neglect, universal design for learning, DD network partnerships (including LEND and about AUCD), and occupations critical to people with a variety of neurodevelopmental and acquired disabilities. We recruited an additional <b>26 students</b> to participate in People First Language and disability etiquette training, and coordinated and participated in three UI sponsored new student recruitment fairs. The UI's ethnic diversity is 74% White, 10% Hispanic, 5% Black, and 2% Asian, with the remainder Unknown. With this predominantly White population base, we had three students who reported as Hispanic (12%), while the other 88% percent reported as Non-Hispanic.	<input type="checkbox"/> Fully achieved <input checked="" type="checkbox"/> <b>Partially</b> <input type="checkbox"/> Not initiated

Figure 1.4 The first goal set by the CDHD for inclusion of additional students into select programs from underrepresented groups. (Fodor, 2014, p.4)

Assistive technology solutions such as interactive software, can help further communicate how an individual with autism operates within their environment and give alternative means for communication for an individual. (Mesa-Gresa et al., 2019) Activity-based educational immersive experiences for young individuals with Autism could lead to a more qualitative response to the required standardized educational content. While some studies point to visual based learning as a possible outlet for young people with Autism, (Trembath et al., 2015) the visual element only serves as an “ingredient” to the solution. Companies like Floreo (2022) acknowledge the need for specialists in this very specific field of study. They are currently developing these types of learning solutions for young people via hardware and software resources to qualified organizations. Leading researchers at Floreo

have explored possibilities for implementing VR as core support for learning development among youth with ASD. In a study conducted by the Floreo lab with contributed pre and post user group analysis: Floreo (Ravindran et al., 2019) collaborated with the special education school Celebrate the Children to collect pilot data on the feasibility and safety of using Floreo's mobile VR platform for training joint attention skills in children with ASD. In addition, the pilot data obtained on a novel joint attention measure designed for use in school-aged children with ASD suggests that training with Floreo's Joint Attention Module was related to improvements in social reciprocity skills in these children. Findings from this pilot study support ongoing research on the practical use of this platform and on the effectiveness of the joint attention training content on social communication skills in ASD.

In a study out of the University of Warwick with 99 participants, (O'Toole, 2017 p. 10) each identifying as preferred visual learners and comfortable wearing Virtual Reality (VR) headsets, were assigned to one of three learning conditions:

Table 1.1 Defined outlets for the learning experiment. Divided into three groups, the learners were instructed to use Traditional Textbook, VR, or Traditional Video learning materials. (O'Toole, 2017 p.19)

Learning Tool:	Traditional	Virtual Reality	Video
Learning Type:	Textbook	Active Control	Passive Control

The learning materials used the same text and learning model for all conditions. Participants in the traditional and VR conditions had improved overall performance (i.e. learning, including knowledge acquisition and understanding) compared to those in the video condition. Participants in VR also showed better performance for knowledge retention than those in the traditional and the video conditions. Participants in this study were vetted to have an affinity for visual based learning.

Table 1.2 Shown below is an analysis of the outlets for engagement and experiential application methods Floreo integrates into their development process.

VR Technology	Activity-Based Learning	Tactile Sensory Integration	Auditory Sensory Integration
<p>Users contained in a fully immersed environment causes high engagement for users with an affinity and capacity for visual learning. Content that provides viewers with the opportunity to explore a virtual world in conjunction with steady storyline flow is critical for performance effectiveness. Since viewers are in control of their own experience, attention is easily diverted to aspects in view such as characters, environment, and landmarks apart from the primary focus. (O’Toole, 2017)</p>	<p>Based on the theory of applied behavior and learning. It can be used to help individuals with autism build important sets of skills across many domains. Taking complex skills/tasks and breaking them down into small sized challenges and exercises. (Özen &amp; Ergenekon, 2011)</p>	<p>Based on the scientific process that initiates the brain by integrating physical touch into an experience. If a person has poor sensory integration with an object, this then impacts the ability to function and potentially develop a skill around that object. Tactile response integration is typically used as sensory adaptation in practice. Many patients with posttraumatic stress disorder (PTSD) feel overwhelmed in situations with high levels of sensory input, as in crowded situations with complex sensory characteristics. (Mueller-Pfeiffer et al., 2013)</p>	<p>Involves treating a person with an ASD through their sense of hearing. In AIT, musical sounds are washed through a filtering apparatus that alters them, emphasizing some tones and reducing the intensity of others, while the person receiving the treatment listens through high quality headphones. In theory, the brain has to work to re-integrate the filtered sounds. (Dawson &amp; Watling 2000, p. 419)</p>

Under proper guidance and collaboration from key-specialists in not only the Autism community; but technology, art, mental health, and social support communities The Autism Mixed Reality Institute (AXRI) is focused on establishing meaningful networks for change that drive better understanding of community growth through XR platforms. By connecting integrated research methods from extended reality and social support systems, AXRI supplements the development of technology solutions, social infrastructure, and inclusion for the Autism community, and wider Neurodiversity community in Idaho. Extended reality technology that emphasizes the value in visual learning and high user engagement can lead to developing community growth across the internet. Applying the community capitals framework to a virtually connected community to encourage community growth, suggesting that open collaboration among community organizations in virtual environments progresses the level of agency, adaption, and engagement.



## Chapter 2: Autism Mixed Reality Institute (AXRI)



The Autism Mixed Reality Institute, established in 2019, seeks to improve the quality of life for individuals and their families affected by Autism; more broadly the Neurodiverse community in Idaho. The core mission is to build and provide atypical learning development methods for neuro-atypical people and their families to aid their pursuit for the same happiness as neuro-typical people. As mentioned in chapter 1, By connecting research efforts from extended reality research and social support systems the organization supplements the development of technology solutions, social infrastructure, and inclusion for the Autism community, and wider Neurodiversity movement. Collaborating with community leaders by progressing the level of agency and engagement in virtual environments for users through adaptive experiences, as represented in Figure 2.1. AXRI's primary values and standards are to maintain a neurodiverse model of engagement regarding the Autism community and families, designating thoughtful time and effort into each solution developed.

The growing number of members in the organization has influence for decision making. Leadership roles initially were established impart by current board of directors, advisors, and project developers. [Table 2.1]

Table 2.1 Leadership Organizational Chart: (Blue: Board Members) (Green: Project Developers)(Orange: Advisors)

Mitchell Alexander / Founder	Mitch leads the effort to establish and manage the organization. Lead the funding campaign and board.
Brendan Smythe / VR1 Arcade	Brendan develops operations manuals for Autism XR Research Facilities to ensure a smooth and predictable experience. He will then help run operations at the facilities by updating workflows, procedures, equipment, and other systems.
Jim Bradbury / Idaho Virtual Reality Council	Jim helps to establish the organization and, as a representative of the Idaho Virtual Reality Council, work towards enabling strategic partnerships for research, funding and equipment.
John Anderson /Lead Virtual Technology Laboratory Administrator/ University of Idaho	John leads the research effort and serve as liaison between AXRI and the University of Idaho.
Tiam Rastegar / Trailhead Boise	Tiam serves on the Board of Directors and also as an advisor on administering a start-up non-profit organization.
Julio Gonzalez / Lead Project Developer & University of Idaho Graduate Student 2019-2022	Julio leads the research and development focus on conceptualizing a response to design challenges associated with creating XR solutions.
Ron Oberleitner/Behavior Imaging	Ron serves as a healthcare advocate and advisor in the development of research solutions and collaborations.

Table 2.2 The service model and functions are separated into three divisions, each geared towards the designation of time and resources.

XR Accessibility	Collaboration	AXRI Software Development
VR/AR/MR equipment distributed and/or available to individuals and families that may benefit from the use of pre-installed applications. Made available as resources.	Partnering and collaborating with community members throughout Idaho to meet needs of individuals and groups in the autism and neurodiverse community.	AXRI developed virtual platforms providing educational experiences powered by community members and in-collaboration with partners.



Figure 2.1 Embedded into the core function, values, and standards of AXRI are principals intended maintain constant open channels to various community leaders.

Organizational core principles (Figure 2.1) and a primary service model (As shown in table 2.2) was necessary to establish foundational processes for each of the members to follow moving forward. Following the establishment of the organization in August of 2019, the institute was able to workshop organization goals for the next three years; (As shown below in table 2.3). This was also an opportunity for each member to reiterate what time/energy/resources they will bring to the table to promote better synergy for the cause. Although we agreed on speculating that our hardware and software needs may change in the future as the XR design industry may change. Some of these goals involved cultivating meaningful relationships in the healthcare community and various educational institutions, as well as ideate and research employment and educational training modules for individuals that live with autism, additionally to employers who can use such training in their standard training practices.

Table 2.3 Organization goals for 2019-2022

Year 1		Year 2		Year 3	
Building Operations	Service Model Operations	Industry Research	Platform Development Pipeline	Project Incubation	Provide and Publish Vital Community Research.
Branding Development	Showcase Research Posters Gallery	Hardware and Software Testing	Seek out and Attend XR, Autism, and Neurodiversity conferences	Establish and Connect with Potential Clientele	Hardware and Software Assessment
Establish Communication Systems	Preliminary Research and Testing				

In October 2019 the Autism Summit conference, hosted at the University of Idaho Boise campus Water Center Building, allowed AXRI to gauge current developments within telehealth and autism social support, and to make meaningful connections through networking with attendees throughout Idaho. The conference consisted of three speakers and three panels, each ranging in expertise from pharmaceutical to social work in developing better practices when addressing the needs of people living with autism. Each facet of the conference concluded that most individuals living with autism will have a unique case/lifestyle/need; adding, that addressing one specific way would be not as effective as conjoining efforts across disciplines. A consensus among the leaders of AXRI was met that having a network of specialists and advisors will remain crucial to developing best practices for people living with Autism and the wider Neurodiverse community. Continuing to attend conferences like the Autism summit will also be crucial in the future to better strengthen connections and networks to better service the Autism community. Following the closing of the event, AXRI led several individuals up to the AXRI/VTL (Virtual Technology Lab), f). Shown below in figure 2.2, located at the University of Idaho Boise campus. Prior to this meet, mockups were made by junior undergraduate VTD students as a design prompt which sparked major interest in conversation from the healthcare administrative community. These conversations also assisted in workshopping several potential directions AXRI could go with the right amount of community resources. Having a VR headset present was vital in these conversations for many possible applications (Coping Strategies, Therapy Development, Data Collection, Lifelong Learning Simulations, Educational Platforms).



Figure 2.2 The AXRI/VTL located at the University of Idaho Boise campus.

Conferences like these bring the greater Idaho community together to not only celebrate achievements in the community but share, socialize, and grow. The summit specifically has been an increasingly common place for community groups to collaborate and connect on a neurodiverse model of engagement when servicing the Autism community. The result is a culture of inclusion, empathy, and understanding dedicated to community capital growth.

### **Chapter 3: Community Capital Methodology and Engagement**

Utilizing each research methodology discussed in chapter 1, associated with extended reality technology, activity-based learning, strengths-based analysis, and sensory integration, AXRI has set out to collaborate and partner with Idaho organizations engaging with the autism and neurodiverse. Collaborating with experts in Education, Mental Health Advocacy, Sensory Integration, and Extended Reality Technology as core principles gives the organization clear direction for engagement with community leaders. An organization's primary assets are the people who are the sole facilitators in what brings the group's effectiveness forward and the people they serve.

Flora et al. (2015) defines community in several terms, one being the place in which a group of people interact with each other. Another being the social system, more specifically the way in which the needs of the people are met. And lastly, is the shared sense of identity held by the group. In summary, community is often referred to as a shared sense of space; social or physical. Flora et al. (2015) added that every community, however defined, has resources within it; when those resources or assets are fostered to create new resources, they become capital. Over the course of many years of working with rural and urban communities, the authors of the community capitals framework have found that dividing invested resources into seven “capitals” is extremely helpful in fostering change through analysis and action. The capitals, [Table 3.1] both individually and together contribute-to or detract-from sustainable communities. Sustainable communities strive to bring economic security to all, foster a healthy ecosystem, and offer social inclusion to all residents. By applying the right numbers of people to a solution you are enabling a higher number of perspectives into the development process of a solution. Flora et al.(2015) then mentions drawing from each individuals' strengths and experience informs the human capital of a community. Typically observed with geographic communities, AXRI leading the neurodiverse and autism community in Idaho into XR spaces, community capital can be distinguished through digital access, virtual presence, and online equity.

Table 3.1 The 7 Community Capitals (Flora et al., 2015 p. 15-16)

Natural Capital	Includes the air, water, soil, wildlife, vegetation, landscape, and weather that surround us and provide both possibilities for and limits to community sustainability. Natural capital influences and is influenced by human activities. It forms the basis of all the other capitals.
Cultural Capital	Determines a group's worldview, how it sees the world, how the seen is connected to the unseen, what is taken for granted, what is valued, and what things a group thinks are possible to change. Cultural hegemony allows one social group to impose its worldview, symbols, and reward system on other groups.
Human Capital	Is the capabilities and potential of individuals determined by the intersection of nature and nurture (social interactions and the environment). Human capital includes education, skills, health, and self-esteem.
Social Capital	Involves mutual trust, reciprocity, groups, collective identity, working together, and a sense of a shared future. Bonding social capital consists of interactions within a specific group or community, and bridging social capital consists of interactions among social groups.
Political Capital	Is the ability of a community or group to turn its norms and values into standards, which are then translated into rules and regulations that determine the distribution of resources. Political capital is also mobilized to ensure that those rules, regulations, and resource distributions are (or are not) enforced.
Financial Capital	Includes savings, income generation, fees, loans and credit, gifts and philanthropy, taxes, and tax exemptions. Financial capital is much more mobile than the other capitals and tends to be privileged because it is easy to



	measure. Community financial capital can be assessed by changes in poverty, firm efficiency, diversity of firms, and local people's increased asset
Built Capital	Is human-constructed infrastructure. Although new built capital is often equated with community development, it is effective only when it contributes to other community capitals. Built capital can cause deterioration of the other capitals when it is deployed without regard for its consequences. Built capital includes information technologies, chemicals, bridges, railroads, oil pipelines, factories, day care centers, and wind farms.

By applying this framework, to different AXRI projects this study aims to identify community principles and demonstrate a framework for increasing community engagement in the neurodiverse community. With an understanding of how each of these community capitals are identified in the Idaho Autism community, AXRI has researched and developed projects, and identified measures to engage with each community capital where collaborations, resources, and assistive solutions are necessary.

## **Community Capitals Synthesis:**

### Social Capital: AXRI & BlueCross of Idaho

By establishing connections to leaders throughout Idaho who each have an affinity for creating opportunities for the Autism community and wider neurodiverse community; AXRI's efforts to generate resources and services allow for growth in creating further awareness and advocacy. Innovating or strengthening services already in place allows for individuals and families to have opportunities to benefit from virtual services. Integrating collaborative research methods as seen through Floreo Inc., utilizing sensory integration, auditory integration, activity-based learning strategies, and integrated extended reality technology AXRI proposed the development of a virtual tool to be integrated into VR platforms. The development team proposed the ideation of the prior mentioned tool that would jumpstart a project that could lead to further growth for the organization and potential public services through the BlueCross of Idaho. Results came to develop a system that allows users/developers to adjust virtual world properties to cater to the sensory/social/emotional needs of the user based on findings, supported by the National Institute of Neurological Disorders, (Dalluwatte et al. 2014) that point to a higher number of children with ASD having oversensitivity to light. By not only building the virtual environment to be comfortable but inclusive, this could encourage users to learn at a higher capacity and potentially greater knowledge retention. As shown in figure 3.1, the tool would be a plug-in virtual command utility module attached to the player avatar. Through development progression controls would enable parameter functions like: Light Intensity and Color Control, Sound Intensity Controls, and Spatial Object Distance Control.

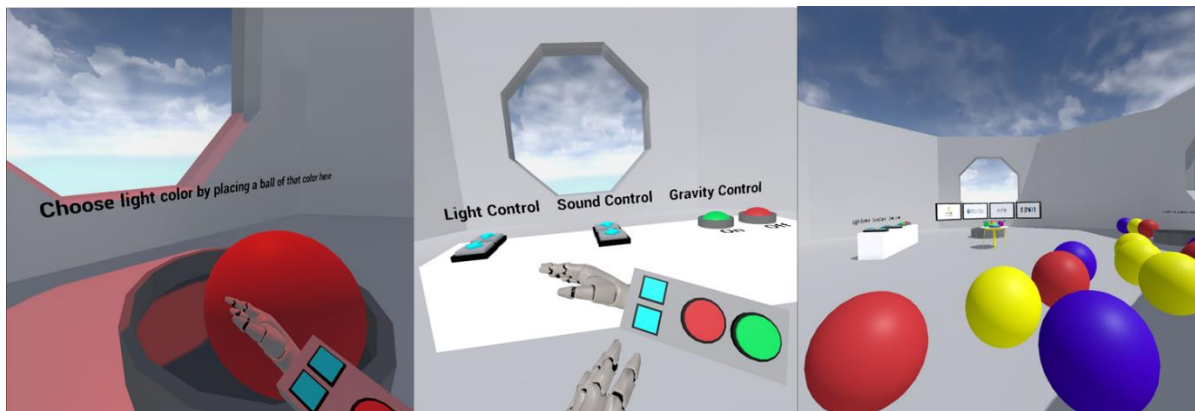


Figure 3.1 Early prototype demo of the BlueCross Idaho & AXRI VR parameter control plugin.

Finding a potential supplemental tool for individuals with Autism and to be able to control light and sound parameters when immersed in a virtual environment are where this initiative is ready to grow. Doing so allows the user to calibrate levels to their desired comfort. Oftentimes when developing a virtual or real environment, lighting and sound solutions are static and unalterable. Having a virtual tool plugin that's useable in other applications provides further options for users with light and sound sensitivities. Future iterations of this project are to not only integrate the tool with virtual reality, but mixed reality as well, enabling users to use mixed reality headsets to have an augmented status while interacting with physical reality. By providing access to individuals with this type of inclusive software development of a service model could contribute to the social capital of the Autism, greater Neurodiverse community, for anyone who has sensory overstimulation.

Following a pledge of \$2500.00 from the BlueCross of Idaho to jumpstart this project, and to lead an integrated prototype to an instance-based research group; the COVID-19 pandemic quickly brought the momentum and funds for the progression to a halt/stand-by status.

### Human Capital: AXRI Virtual Campus

In direct response to the COVID-19 pandemic, (United States Census Bureau, 2021) the consensus found that close to 93% of households reported children engaged in some kind of online learning. Patterns of digital inequality can be attributed to socioeconomic differences in the use of online resources. Inequality in access to computers and the internet

has been widely documented. Lower-income households are less likely than higher-income ones to have internet access and computer availability. This forced households and school districts to be flexible as they adapted to a change in the delivery of education. Equipping communities across the state of Idaho with the means of learning from one another contributes to the overall growth of where remote networking allows for a full range of collaborations to occur. Encouraging each area of the state to collaborate creates the value.

A research study composed by Doan Thi Hue Dung (2020) from the Department of English Language at Hong Bang University found that out of 205 students and 16 lecturers, virtual courses have been recognized as by more than 82% of participants for their positive impacts on the student's learning experience. Although the use of virtual classrooms has accelerated as a contingent solution to provide the instruction to students was required due to the constraints of the pandemic, the two most critical issues that raise concerns are the digital division in access and the lack of social skills among students in virtual learning environment. With the digital divide growing even more prominent than before, many learners may require digital learning rather than physical learning (Idaho Department of Labor, 2017). The Idaho Department of Labor (2017) found that 62% urban households, and 59% Rural had stationary access to the internet. Without disregarding that many learners would still prefer physically based learning, an opportunity for growth in digital learning sectors remains available for youth learning development. Addressing the necessity for internet access takes priority. Having the built capital to learn and communicate is a now common necessity for all educational institutions. Additionally, (Dung, 2020) finding that more students and teachers thrive using virtual learning put into question the exploration for growth in this field. Providing the necessary tools for students and teachers who thrive under virtual learning frameworks, and have an affiliation for visual experiential learning would have an opportunity to thrive in an educational setting contributing their access to social, financial, and built capital.

Following a 6-month post-March 2020 reassessment of organizational goals and progression and research into how to engage with the community via educational XR tools; AXRI underwent development to build and provide a 3D Virtual Hub Application to be accessed via Extended Reality Platforms (VR/AR/MR/Mobile/Web). Serving as an

introduction and access point for individuals on the spectrum seeking to engage in a collection of digital resources. Each developed in part by and for the community. From this hub there would be access to various virtual interactive activities such as: Strategy Development, Counseling, Education, Social Skills Development, Employment and Career Support, Telehealth, and many more. By establishing the virtually built capital, communities would have a space where many of their social needs could be met.

Financial Capital: McDonalds & Idaho Voc. Rehab & AXRI Collaboration, XR Training and Career Development

This collaboration is proposed to develop a program for employee users to learn and repeat training modules to further develop on-site responsibilities at a predefined McDonald's location. Employees with Autism could potentially benefit from having an accessible training module that clearly defines learning content structure. Equally important, will be the social infrastructure of the defined back-end relationships to this collaboration. Idaho Vocational Rehabilitation Services being available and willing to assist with learner advocacy and job placement would help ensure employee retention and quality experience gained for new hires. By ensuring a facilitator to advocate for the employees in-training, as well as restaurant leaders who are on board with progression the ASD and wider Neurodiverse community could align with core AXRI standards.

McDonald's Foundation + Idaho Vocational Rehabilitation Services, to research and develop a learning method and service model based in VR for newly trained employees and leaders. Figure 3.2 With contact and interest established, AXRI seeks to develop and provide an additional supplemental learning method and employment opportunity for individuals with Autism starting in the local Boise, ID community. In conjunction with Idaho Voc. Rehab. Services, execution of supplemental training will be met with job coaching/facilitation services create the opportunity for community growth through collaborative social capital.

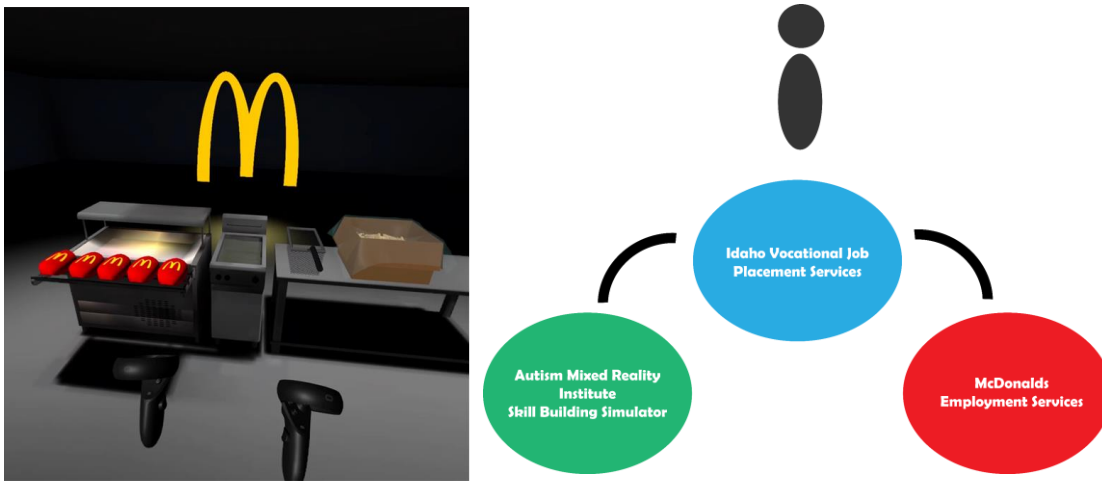


Figure 3.2 On the left, early prototype of proposed software. On the right, proposed service model emphasizing the application of a moderator role in the collaboration.

By working with community leaders to establish secure employment opportunities AXRI has the potential to financially secure steady income for individuals with Autism and the wider neurodiverse community. Additionally, through securing sponsorship from the McDonald's foundation in creating software development opportunities for individuals among the neurodiverse community. Employing first-hand advisory roles from individuals among the autism community and the wider neurodiverse community. This strengthens AXRI's social capital with key community members playing a role in the future development of community growth.

#### Cultural Capital: Surel's Place Collaboration

In October 2021, a collaboration exercise with a Boise Art Community (Affiliated with Surel's Place Art Institution), Idaho Virtual Reality Council Tech Community, Neurodiverse AXRI Community, and Indigenous LINK community took place highlighting the value in sharing stories, experiences, and artistry in a collaborative web-based XR platform Spatial.io [Figure 3.3]. The group found that through the process of coming together to share their stories the complexity of how many more opportunities had presented themselves. Facilitated and led by immersive industry veteran and artist Kathleen Cohen, each group's social, human, cultural, and built capital to be explored. Through her work as the first immersive artist in residence, a communal network among the communities was established. What became clear through this process was enabling the means to highlight key members and artists in each community to continue to connect people together and establish community growth for creators and storytellers alike.



Figure 3.3 Immersive XR storytelling event led by artist in residence Kathleen Cohen. Group virtual selfie of some of the attendees.

The AXRI development team developed one of these shared spaces to create a community space where organizations like ArtAbility, are encouraged to connect individuals among the disabilities community from the physical world to the virtual by showcasing art work. Out of the plethora of social situations, which may be harder for individuals with Autism to navigate; virtualizing social interaction is how community members have been able to share stories, experiences, and interactions. AXRI's development of a shared space has allowed for ArtAbility to hold a virtual art gallery for its members. Other members of the Autism community such as from Ron Oberleitner family, have been able to use such a platform to spread advocacy and awareness throughout virtual events like these.

A steady analysis of the platform being used and where the digital-art community can bring value to the collaboration was explored. As the primary builder of the virtual spaces for which these connections were made, many benefits as well as constraints became apparent through the process. The initial approach to this collaboration was to have a platform for telling vital stories of locations in Idaho. [Figure 3.4] Collaborator Jon Waterhouse found that with the future use of a platform like this can not only tell vital stories regarding humanity's connection to the earth, but also connect their communities to other indigenous communities through a network called the Living Indigenous Network for Knowledge (LINK). By utilizing a more secure platform such as Framevr.io, one that is password protected and authenticated, LINK could generate a virtual space within this platform to continue the sometimes expensive and difficult task of bringing world-native leaders together. In recent years it hasn't been out of question to see a native community establish virtual sovereignty in the realm of virtualization. Internet access for indigenous remains a

primary necessity for interconnectivity, (Park, 2020) as mentioned in the review of the Navajo Nation's establishment of managing a sovereign regional wireless internet network. Part of this same need for connectivity resonates with indigenous ambassadors who have in the past gone on missions to physically meet other tribal leaders across the world, establishing a sovereign virtual network for them to connect remains as a vital objective.



Figure 3.4 Indigenous LINK XR storytelling space developed on Spatial.io.

AXRI + VR1 Arcade, made a lot of momentum in leading the discussions around XR platforms like Spatial.io. The organization has been working through how to utilize a virtual networking platform to bring individuals and groups in the Neurodiverse community together. Stories by a father of a son on the spectrum, and showcasing of two more VR artists on the spectrum allowed the organization to contribute in creating awareness and advocacy for the community. [Figure 3.4] ArtAbility CDHD, was one of the groups within this community that found an opportunity to showcase art pieces made by their participants as well as their department's work force. Although the possibility of virtualizing the workshops typically done in-person at ArtAbility, on an XR platform like Spatial.io the disparity between what is feasible to execute a virtual VR workshop regarding hardware technology shows limitations in the Moscow community.



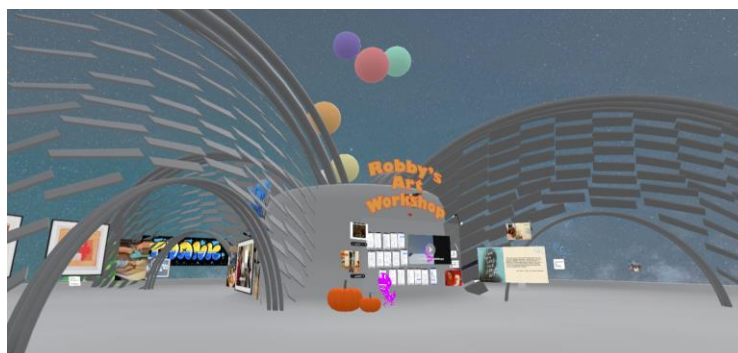


Figure 3.5 Neurodiversity XR virtual environment. Emphasizing three spaces for community advocacy and awareness.

By Kathleen facilitating the juncture between the communities, the social and human capital of Surel's Place encouraged audiences to engage with the stories being told. That being established, housing immersive/digital artists never before done with their art residency also encourages future digital/immersive artist to find similar ways of bringing communities together. Virtually connecting in this way allows for more artists to be seen, heard, and found through an interactive and immersive platform which exhibited the possibilities for future artists.

Many members from this community helped make this collaboration possible. By supplying hardware and software assistance their presence speaks to the relevance in having tech-community groups being involved with other communities showcasing the value in social collaboration and technology. Through the use of XR web meeting platforms like Spatial.io, users are able to engage with each other on a level of immersion that goes deeper than what you'd see with a platform like Zoom. By utilizing an opportunity with Surel's Place Boise, the groups are networking with the coexistence of the art community and tech community of Boise to create larger opportunities for change.

By analyzing what AXRI has been able to establish and continue to allocate time and resources into, then synthesizing what areas of focus show promising growth in each community capital show are varying degree of engagement and opportunity. With the establishment of a network of knowledge on an immersive platform, XR storytelling can be a catalyst for communities that have lived here and for generations to come.

### Built Capital: Persistent Interactive Virtual Environments

With AXRI's primary in person lab located at the Virtual Technology Lab at the University of Idaho Boise campus, AXRI is able to house software development equipment, VR/AR/XR equipment to be utilized by members and collaborators of the organization. With this space, in person meetings with families allow for meeting in a safe and welcoming space to navigate challenge that would address their needs in creating the most ideal solution. The young adult population among neurodiverse communities have opportunities connected to Idaho Vocation Rehabilitation Services. Having a center for integrated social services that meet the community's needs where they're at cognitively, such as with skill-building learning programs and job coaching services, allows for substantial community growth and engagement.

In establishing persistent virtual environments, AXRI has established the means for individuals to explore, socialize, and create with ease in safe and accessible virtual platforms. By providing digital tools to house art galleries, in collaboration with Surel's Place + ArtAbility, for individuals that would otherwise feel uncomfortable doing so in person, establishing virtual capital is where many financial solutions can grow as well. Finally, with virtual networks becoming more available and established online, an individual or group's online presence can be their sole means for interacting with the world if they choose. Having a resource like virtually built capital moderated by a community gives ownership, agency, and presence to the communities.

### Spatial.io Platform Analysis:

- Opportunity for artists from each community to have a space in one of Boise's prominent art community networks.
- Opportunity for digital art specialists to collaborate in assisting physically based artists to utilize virtual platforms, encouraging inclusivity with artists in tech.
- Platform fidelity still in progress, necessary user interface functions and user agency representation limit participant interaction with virtual art galleries.
- Outlets for Engagement include PC, Mac, Mobile, and VR devices. Broad use of hardware encourages larger accessibility range. However as long as there is internet availability to the user.
- Although utilizing a virtual platform like Spatial.io can reach a vast audience, the established release channel must be as accessible as possible. Language barriers are still likely to occur.
- Regarding art-for-sale, Digital ownership to be recognized and expectations established. Digital content can typically be seen as available for purchase an unlimited number of times per/unit. With growing use and interest in digital ownership with NFT art verification, expectation of ownership must be defined prior. As a release channel coordinator, it would be vital to have a framework establishing potential sales and outlets.
- Better safety and security measures for users and their environments using password protected features are necessities that are currently absent from the Spatial.io platform.

### Political Capital: Idaho Legislation Autism Insurance Reform, CDHD Objectives

Organizations and community leaders putting together policy reform as previously mentioned, the disabilities community and wider neurodiverse community could continue to see increased representation power among representative groups. Additionally, with technology solutions becoming more apparent as educational and developmental solutions among children with Autism, more expansive coverage can be explored in the assessment of social work resources. As referenced from the annual CDHD report, improving technical advocacy, higher education programs, and support networks in the State, the CDHD can continue to allocate resources, workforce, and equipment to necessary providers of the community.

### Natural Capital: Access to Immersive Technology

Utilizing the environment across Idaho as an educational tool, while connected to a network that encourages public access, allows the XR community in Idaho to develop accessible educational natural resource education solutions. However, access to networks of information and virtually built capital is limited to community access to internet. Rural and remote locations may have limited access to internet connectivity. With this apparent, the need for allocated municipal networks may be necessary.

With each community's strengths collected and defined, the process for which they work together can cultivate new-larger communities that create more opportunity for people to thrive under. Having a group-wide understanding that each area of focus would bring promising growth towards bringing communities together.

## Chapter 4: Conclusion

To increase advocacy and awareness, AXRI must have more individuals from within the communities in a leadership or key advisory role in the project development process. This will not only help inform better made design decisions to virtual spaces but enable the community to have a stronger and more direct voice in the process. With increasing outreach for projects and collaborations, the organization would highly benefit from more developers on the project development team as a whole; More so, developers from the autism and/or the neurodiverse community. With continued recognition of graduate and undergraduate studies integrated among AXRI collaborations, paid internship opportunities would be able to contribute to students seeking higher education experiences. With additional funds for contracting, software/hardware development, and testing will extend availability teams in the execution of each project. Allocated funds for necessary VR equipment would continue to fulfill the XR Accessibility branch of the organizational service model enabling the distribution of a rental equipment to the community increasing XR accessibility. The establishment of an official project management role to employ, oversee, and lead development teams. With full-time development leadership established, resources and services can be pursued in a timely manner and board meetings would primarily entail administrative connections. By allowing a clear pipeline between project development/management and board decisions established, growth for the organization and community can continue and at higher capacity.

Komives and Wagner (2009) describes how simple goals regarding social change can escalate into more complex endeavors when set in motion into communities. Referencing an example by Charles Strain regarding the "Give a man a fish.." analogy. Strain then alludes to a response to the example, arguing that "teaching someone to fish presumes that the person a) has access to the lake, b) that a corporate conglomerate has not fished out that lake, and c) that our industrial waste has not poisoned all of the fish" (Komives & Wagner, 2009). It's apparent that the analogy intends to determine the quality of social sustainability to a resource system in a person's life. Giving not only fishers a voice in the community, but other groups that rely on the fish; the people that eat the fish, restaurants and grocers, the local economy fish trade can stimulate, the stability of the lake's ecosystem, the people that live by and around the lake. There will always be other factors to consider. It's easy for a leader to

gain a positive response from a community when they are speaking to core issues that affect a group's financial, social, and cultural values. By encouraging community leaders through positive direction, moderators, advisors, and facilitators need to assist in motivating the change; after all, change requires people to ensure its future. What often lacks in doing so, is transparency, nuance, and accountability. To advocate, organize, and lead others in a community calls for a meaningful understanding of what social sustainability means for a community.

Critically understanding the social impact we have on each other is vital to upholding our quality of life. Block (2008) relates the power of possibility to the power we have of our story. The story we've laid behind us and the possibility to pave our own story ahead of us. Without acknowledging the mistakes we've made and the challenges we've overcome, or failed at, we limit ourselves from progression; Block (2008) has described this as an opportunity for transformation. Block (2008) also writes about the appreciation of the paradox. How true hindsight requires honest reflection of the past. What occurs next, is a choice to find freedom through accountability and to all other facets of the human experience. By addressing the past, positive or negative, we have the opportunity to pave a path to follow into our future. Our footprint carries legacy wherever we go; from family members to strangers. The decisions we make, the words we choose, inform our actions; our actions will have meaning to someone; there lies an opportunity for progression and change. Applying the community capitals framework to XR social platforms encourage users to advocate for, and allocate power to, community driven solutions would have higher probability of sustaining and thriving. Whether or not an individual can decide for themselves the factors that affect their daily life, there remains a responsibility of each member in connecting common purpose and community capital.

With the guidance from community members, specialists, mentors, peers, advisors, community leaders will continue connecting people with people by combining virtual technology with necessary social infrastructure to meet the challenges of today.

### Work Cited

- Block, P. (2008). *Community: The structure of belonging*. Berrett-Koehler Publishers.
- CDC. (2020) *Disability & health U.S. state profile data: Idaho*. Centers for Disease Control and Prevention. [www.cdc.gov/ncbddd/disabilityandhealth/impacts/idaho.html](http://www.cdc.gov/ncbddd/disabilityandhealth/impacts/idaho.html)
- Daluwatte, C., Miles, J. H., Sun, J., & Yao, G. (2014). Association between pupillary light reflex and sensory behaviors in children with autism spectrum disorders. *Research in Developmental Disabilities, 27*(2015), 209-215. <https://doi.org/10.1016/j.ridd.2014.11.019>
- Dawson, G., & Watling, R. (2000). Interventions to facilitate auditory, visual, and motor integration in autism: A review of the evidence. *Journal of Autism and Developmental Disorders, 30*(5), 415-421. <https://doi.org/10.1023/a:1005547422749>
- deGiere, G. (2020, December 9). *The Autistic Self Advocacy Network: Abai*. The Arc of California. <https://thearca.org/the-autistic-self-advocacy-network-strongly-condemns-the-association-for-behavior-analysis-international-abai-repost-from-asan>
- Dempsey. (2020). ASAN comments on proposed fair housing rule. *Autistic Self Advocacy Network*. [Autisticadvocacy.org/2020/03/asan-comments-on-proposed-fair-housing-rule/](https://autisticadvocacy.org/2020/03/asan-comments-on-proposed-fair-housing-rule/)
- Disability:IN. (2022) *Neurodiversity @ work employer roundtable*. <https://disabilityin.org/what-we-do/committees/neurodiversity-at-work-roundtable>
- Doyle, N. (2020). Neurodiversity at work: A biopsychosocial model and the impact on working adults. *British Medical Bulletin, 135*(1), 108-125  
<https://doi.org/10.1093/bmb/Idaa021>
- Dung, D. T. H. (2020). The advantages and disadvantages of virtual learning. *IOSR Journal of Research & Method in Education, 10*(3), 45-48. <https://doi.org/10.9790/7388-10030-54548>

Flora, C. B., Flora, J. L., & Gasteyer, S. P. (2015). *Rural communities: Legacy + change*. Taylor & Francis Group. 2

Floreo. (2022) Virtual Reality Therapy. *Floreo VR: Autism Learning*. www.floreotech.com

Fodor (2019) ANNUAL PERFORMANCE REPORT. *Idahocdh.org*, The Center on Disabilities and Human Development (CDHD) Is Idaho's University Center for Excellence in Developmental Disabilities (UCEDD).  
idahocdh.org/Portals/59/Documents/Staff/allStaff/2019/CDHD-SkinnyAnnualReport\_FY19.pdf

den Houting, J. (2019). Neurodiversity: An insider's perspective. *Autism*, 23(2), 271-273.  
<https://doi.org/10.1177/1362361318820762>

Idaho Department of Health and Welfare. (2022). *About children's developmental disabilities*. healthandwelfare.idaho.gov/services-programs/medicaid-health/about-childrens-developmental-disabilities

Idaho Department of Labor (2017). *Demographics contribute to Idaho's digital divide*. Idaho@work. <https://idahoatwork.com/2017/04/13/demographics-contribute-to-idahos-digital-divide/#:~:text=According%20to%20the%20most%20recent,higher%20have%20broadband%20internet%20subscriptions>

Komives, S., & Wagner, W. (2009). *Leadership for a better world: Understanding the social change model of leadership development*. Jossey-Bass.

Mesa-Gresa, P., Gil-Gomez, H., Lozano-Quilis, J., & Gil-Gomez, J. (2018). Effectiveness of virtual reality for children and adolescents with Autism Spectrum Disorder: An evidence-based systematic review. *Sensors (Basel)*, 18(8) 2486. <https://doi.org/10.3390/s18082486>



Mueller-Pfeiffer, C., Schick, M., Schulte-Vels, T., O’Gorman, R., Michels, L., Martin-Soelch, C., Blair, J. R., Rufer, M., Schnyder, U., Zeffiro, T., Hasler, G. (2013). Atypical visual processing in posttraumatic stress disorder. *NeuroImage. Clinical*, 3, 531-538.  
<https://doi.org/10.1016/j.nicl.2013.08.009>

ODE. (2021). *Disability employment statistics*. United States Department of Labor.  
<https://www.dol.gov/agencies/odep/research-evaluation/statistics>

O’Toole, F., (2017). Dr Robert Academic Technology. Kickstart the use of VR at Warwick..  
<https://warwick.ac.uk/services/academictechnology/projects/kick-start-vr>

Özen, A., & Ergenekon, Y. (2011). Activity-based intervention practices in special education. *Educational Sciences: Theory & Practice*, 11(1), 359-362.  
<https://files.eric.ed.gov/fulltext/EJ919906.pdf>

Park, C. (2020). *The cost of connectivity in the Navajo Nation*. New America.  
<https://www.newamerica.org/oti/reports/cost-connectivity-navajo-nation/>

PEAT. (2022). PeatWorks: *The Partnership on Employment & Accessible Technology (PEAT)*. <https://www.peatworks.org>

Ravindran, V., Osgood, M., Sazawal, V., Solorzano, R., & Turnacioglu, S. (2019). Virtual reality support for joint attention using the Floreo joint attention module: Usability and feasibility pilot study. *JMIR Pediatrics and Parenting*, 2(2), e14429.  
<https://doi.org/10.2196/14429>

Idaho State Legislature. (2014). Section 39–3124 – Legislature.Idaho.Gov.  
<https://legislature.idaho.gov/statutesrules/idstat/title39/t39ch31/sect3>

Singer, J. (2017). *Neurodiversity: The birth of an idea*.

Singer, J. (2021). *What is neurodiversity?* Reflections on the Neurodiversity Paradigm.  
<https://neurodiversity2.blogspot.com/p/what.html>

Strain, C. R. (2006). Moving like a starfish: Beyond a unilinear model of student transformation in service-learning classes. *Journal of College & Character*, 19(3), 185-200.  
<https://doi.org/10.2202/1940-1639.1150>

Trembath, D., Vivanti, G., Iacono, T., & Dissanayake, C. (2015) Accurate or assumed: visual learning in children with ASD. *J Autism Dev Disord*, 45(10), 3276-3287.  
<https://doi.org/10.1007/s10803-015-2488-4>

United States Census Bureau. (2021). *Nearly 93% of households with school-age children report some form of distance learning during COVID-19*. Census.gov.  
<https://www.census.gov/library/stories/2020/08/schooling-during-the-covid-19-pandemic.html>

Virginia Department of Education. (2011). *Models of best practice in the education of students with Autism Spectrum Disorders*.  
[www.doe.virginia.gov/special\\_ed/disabilities/autism/technical\\_asst\\_documents/autism\\_models\\_of\\_best\\_practice.pdf](http://www.doe.virginia.gov/special_ed/disabilities/autism/technical_asst_documents/autism_models_of_best_practice.pdf)