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THREADING TRADITION WITH TECHNOLOGY: USING VR TO TEACH RIBBON SKIRT MAKING

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Approval of Thesis

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Dedication

This thesis is dedicated to my late mother, Patricia Rose Soosay.

She always encouraged me to pursue my education, to strive for excellence, and to share what I've learned with others. Although she did not attend university, she dedicated herself to serving the community through her work in nursing. She was incredibly hard-working—at times holding three jobs to make ends meet—and she instilled in me both a strong work ethic and a creative spirit.

I remember her old foot-pedal sewing machine, and how she would mend our clothes, hem our pants, or lengthen our skirts with care. Through her hands, I learned the value of creating, fixing, and nurturing.

She always knew just what to say when I had a bad day, or when I simply needed a warm hug.

I love you, Mom. Thank you for everything.

Acknowledgments

The community of Maskwacis is made up of four nations: Samson Cree Nation, Ermineskin Cree Nation, Louis Bull Tribe and Montana First Nation. Many participants in this research came from these Nations. Without their support, this project would not have been possible.

Friends and family generously contributed by participating in the ribbon skirt-making process and completing the anonymous survey. I also consulted with several Elders from the Maskwacis community, who offered valuable feedback on the study. Their reflections and blessings – shared anonymously – greatly enriched the project and helped ensure it was carried out with cultural respect and integrity.

The committee that supported me throughout this process dedicated countless hours to listening to the progress of my thesis. Its members came from diverse disciplines at Athabasca University representing the Faculty of Science and Technology, the Faculty of Humanities, and a local member of the Maskwacis community. Their encouragement, guidance on where I needed to focus, and thoughtful suggestions for strengthening my research were invaluable.

In addition, I am grateful for the recommendation to include Elders from my own community. Working with them was both rewarding and enjoyable—they showed genuine interest in my project and played an essential role in deepening my understanding of Indigenous knowledge and community protocols. Although they chose to remain anonymous, I will always value their expertise, generosity, and kindness.

Abstract

While Virtual Reality (VR) is increasingly acknowledged as a significant tool for cultural learning and language revitalization, it currently lacks empirical support and a unified theoretical framework in Indigenous contexts. This research investigates the application of immersive VR in Indigenous teachings, particularly focusing on passive seated experiences. Through various theoretical lenses, including Behaviourism, Constructivism, and the Cognitive Affective Model of Immersive Learning (CAMIL) it analyzes learner interactions in digital cultural spaces. Findings indicate strong Cognitive Presence and low cognitive load when VR design aligns with learners' cultural contexts and self-directed Humanistic engagement. The study emphasizes Two-Eyed Seeing (Etuaptmumk) as a pedagogy that integrates Western instructional strengths with Indigenous knowledge, concluding that VR, when based on dual-perspective pedagogy, can empower Indigenous sovereignty and promote cultural continuity.

Keywords: virtual reality, experiential learning, cultural learning, Two-Eyed Seeing (Etuaptmumk), immersive learning, cultural revitalization, pedagogy

Preface

This thesis explores whether Virtual Reality (VR) can offer an interactive and immersive learning experience within a cultural context. Participants were introduced to this experience through both a Western and an Indigenous lens. The goal was to explore the concept of Etuaptmumk, or "Two-Eyed Seeing" – the ability to view the world through both Indigenous and Western perspectives. As an Indigenous person myself, I – like many others – was primarily educated through a Western framework. This thesis utilizes Etuaptmumk as a guiding principle to reconcile these two worlds, demonstrating that when combined they offer a deeper and more holistic way of knowing.

A holistic approach engages the physical, mental, emotional and spiritual aspects of a learner. VR is a unique tool in this regard because it can simulate physical environments while evoking emotional and spiritual connections to land or story. While a Western perspective often breaks things down into small, separate parts to be studied, an Indigenous holistic view looks at how those parts function in a cycle, acknowledging our connection to culture and ancestors. Ultimately, VR emphasizes that knowing comes from doing and feeling, not just thinking; it provides a “lived” experience that bridges the gap between abstract concepts and real-world connection.

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Chapter 1. Introduction

When deciding on the focus of my research, I was drawn to virtual reality (VR) based on my previous work in another course. At the same time, I wanted to learn how to create something traditional from my culture. I have never owned a ribbon skirt, yet they have become an important part of many ceremonies and celebrations in my Maskwacis community. My social media feeds were filled with artists showcasing their ribbon skirt designs, and I felt inspired to learn more about the practice myself.

Bringing these interests together felt like a natural next step. I thought it would be meaningful and exciting to learn how to film a VR video while also learning how to make a ribbon skirt. Once I understood how to create the VR experience, I knew it would be important to have members of my community test the video to see whether they could learn the process alongside me. To my knowledge, combining VR technology with traditional cultural knowledge in this way has not been done before, making this research both innovative and personally significant.

To begin this project, I first needed to learn the technical side of creating a VR experience. This meant purchasing the necessary equipment and teaching myself how to film with a 360-degree camera. It was a genuine learning curve—experimenting with camera placement, adjusting angles, and determining the timing between shots. At the same time, I sought out community members who were willing to teach me how to make a ribbon skirt. After sewing my way through three skirts, I finally began to feel confident in the process.

My hands-on experience learning VR naturally led me to consider how this technology functions in educational contexts. Research on immersive VR highlights its pedagogical strengths, including placing learners within interactive, stereoscopic environments and using interfaces that mirror real-world gestures and movements. Rather than replacing traditional instruction, VR enhances it by offering interactive learning experiences that extend beyond the limits of the classroom (Cook et al., 2019; Iron, 2023; McLean, 2021).

My research question –"How can immersive Virtual Reality (VR) support the teaching and learning of Indigenous cultural skills, such as sewing a ribbon skirt, through the integration of Western educational theories and Indigenous epistemologies like Etuaptmumk (Two-Eyed Seeing)?" – developed throughout my project. The research methods I chose were to compare the effectiveness of VR-based learning to traditional instructor-led approaches, employing inductive reasoning – particularly generalization – to draw conclusions through an anonymous survey from a small sample of Indigenous participants. The mixed-methods approach included qualitative observation during the VR sessions and quantitative data collection via the anonymous survey.

In this thesis, I will begin an exploration of the literature review in two parts (Chapter 2), first an investigation into how VR is being used today, how it is being used to instruct in cultural learning through western pedagogy, and Two-eyed seeing. Then through a theoretical analysis (Chapter 3) as it relates to the ribbon skirt project I was implementing. The methodology (Chapter 4) includes the research process, data collection, VR video creation, survey creation, participant instruction and informed

consent. Results and data analysis (Chapter 5), specifically the survey, participant responses and elder interviews. Then, the discussion (Chapter 6), the theoretical alignment which presents the findings, their significance. In the conclusion (Chapter 7), I wanted to summarize the limitations of the research, and recommendations for future research.

Chapter 2. Review of the Literature

Virtual reality is still relatively new in classroom learning, but research has explored its use in several areas. VR is already being applied in virtual field trips (Chen, 2009; Cook et al., 2019; McLean, 2021; OurWorlds, 2021; Shih, 2015; The Robertson Program, 2022), allowing students to explore dangerous location, study intricate systems (Chen, 2009; Cook et al., 2019), engage in lab environments (Cook et al., 2019; Mousavi et al., 2023), immerse themselves in art education through virtual museum tours, and train for specific workforce skills, among other complex subjects (Bolduc & Simpson, 2020; Boudreau & Anis, 2024; Cook et al., 2019; Johnes, 2023; Mills, & Regenbrecht, 2023; OurWorlds, 2021; Shih, 2015). As a computer-mediated, three-dimensional, multisensory, and interactive simulation (Chen, 2009; Pederson et al., 2022), VR offers a dynamic learning experience.

There are three primary ways to engage with VR: walking, standing, and sitting. For this project, I chose the seated experience to teach how to sew a ribbon skirt. I created a VR video from a first-person perspective, using a 360-degree camera to provide seated instruction. It is sometimes referred to stereoscopic vision 3D which is combining the separate images from each eye to create a single image that makes it possible to see in three dimensions.

Why am I using VR for teaching? VR is known to enhance memory, and knowledge retention by creating an interactive learning experience (Berti, 2021). It helps engage students with new concepts, improving their critical thinking skills, and helps foster deeper involvement with the material (Berti, 2021; Johnes, 2023). This heightened

engagement (Berti, 2021) not only sparks the learner's interest but also facilitates experiential learning, where students can simulate real-world experiences. Additionally, VR has been proven to build emotional intelligence, awareness and understanding (Johnes, 2023).

In addition, seated VR instruction is becoming increasingly popular in cultural learning, offering immersive and accessible experiences that enable students to explore diverse cultures, histories, and art forms from a seated position. Some notable examples of existing seated VR applications in cultural education include:

- Indigenous Cultural Experiences: Learners can immerse themselves in cultural VR environments such as what ImmersiveLink (n.d.) offers, Nishga B.C. Project (Johnson, 2020), Anishinaabe's River Manoomin (wild rice) (The Robertson Program, 2022; Young, 2024), offering virtual experiences that expose them to Indigenous traditions, sacred sites, and cultural practices.
- Traditional Craft Workshops: VR is being used to teach traditional crafts, allowing students to virtually observe and participate in processes like weaving, pottery making, or beadwork. This hands-on approach enhances both cultural understanding and skill development, offering a deeper connection to the craft and its cultural significance.

Before engaging the theoretical insight, I am exploring in this research I needed to review other theories that benefit learning, especially when it comes to VR. There are various theoretical perspectives and methods developed throughout the years that will need to be introduced. Current research using VR is mostly in science education (Berti,

2021) with only a handful of empirical studies examining language education (Condon, 2019). Language education from the perspective of cultural learning VR is great for this immersive experience. Few studies exist that address the impact of highly immersive VR for cultural learning. This lack of empirical research may be due to the challenges implementing VR in educational settings (Berti, 2021).

Up to now, the theoretical foundations of using virtual reality in education are not widely addressed, especially from an Indigenous lens. Indigenous world view is only emerging with the growing number of Indigenous researchers. Research is needed to gain more insights into such theoretical foundations that are indispensable to enable effective, efficient, and appropriate utilization of the technology for education purposes (Chen, 2009). Buhler states (2024, para. 7), “Indigenous worldviews are inherently land-based, embodied forms of Knowledge. In other words, spatial storytelling and teachings require participants to physically connect with a location to receive knowledge — you must experience and embody the space.”

While reviewing the literature, I realized I needed to deepen my understanding of VR technology and the components involved in its creation. I focused particularly on the types of cameras used to produce VR videos, especially those that support the stereoscopic effect. Initially, I purchased a VR camera with a single lens but quickly discovered that it could not produce the necessary equirectangular projection, which requires dual lenses. As part of the study, I also explored how to create immersive environments using VR video and examined the various ways VR is currently being used in educational contexts. Specifically, I investigated how VR is being applied in Indigenous

teachings through Internet websites that have VR videos (Buhler, 2024; ImmersiveLink, n.d.; OurWorlds, 2021; PBS SoCal, 2023; The Robertson Program, 2022; Young, 2024). Most examples relied on seated VR experiences, with applications ranging from cultural revitalization and language learning to traditional craft workshops and immersive cultural storytelling. This exploration also highlighted the growing acceptance of Two-Eyed Seeing as a guiding pedagogy in Indigenous education, an approach that is central to this project (Jeffrey et al., 2021).

VR in Education

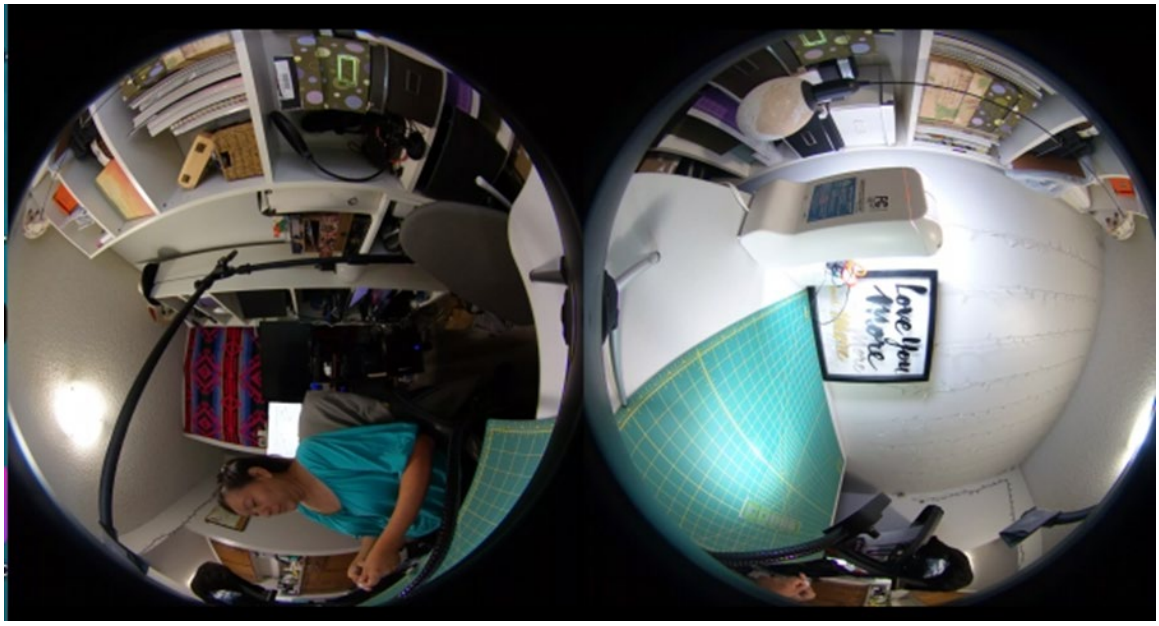
In the field of education, VR offers learners an immersive and interactive learning experience, allowing them to comprehend challenging concepts and ideas (Marougkas et. al., 2023) focusing on understanding the cognitive and affective factors (Mousavi et. al, 2023). VR is a collective name for specialized, widely used electronic technologies designed to create a virtual environment in which the user can feel as if they exist in physical reality (Katona, 2021). The aim is to provide an overview of VR-based education and the possibilities of teaching in a virtual environment.

This immersive experience is often referred to as stereoscopic 3D vision, which involves merging the separate images perceived by each eye to create a single composite image that allows for depth perception (Immersion VR, 2025). The term stereoscopy originates from the Ancient Greek words stereós ("firm" or "solid") and skopeō ("to look" or "to see") (Wikipedia, 2025). Like binocular vision, VR headsets use two slightly different images – one for each eye (or fisheye, see Figure 1) – to produce a

stereoscopic effect, immersing users in a three-dimensional environment (Immersion VR, 2025; Strojney & Duzmanska-Misiarczyk, 2023).

Figure 1.

Fisheye view or Stereoscopic view



Note. This photograph shows the results of stereoscopic view, or the raw footage before it is stitched to the equirectangular view.

Figure 2.

Equirectangular View

Note. The resulting view resembles a globe that has been unwrapped and flattened, known as an equirectangular projection (See Figure 2.), where the viewer sees only a portion - or "slice" - of the full 360-degree footage at any given moment, depending on their field of view (Rowell, 2019). 360-degree cameras capture spherical imagery and convert it into this omnidirectional, planar format – also called equirectangular – for playback in VR environments (Rodgers, 2023).

According to Sultan (2019), there are several types of VR, each offering varying levels of immersion and interaction: non-immersive, semi-immersive, fully immersive, augmented reality, and collaborative VR. Non-immersive VR involves interacting with a virtual environment through a standard desktop interface, where users control characters or activities within the software. Semi-immersive VR combines elements of both non-immersive and fully immersive experiences, often involving a computer screen or VR headset, but with limited physical interaction beyond visual engagement. Fully

immersive VR provides the most comprehensive experience by placing users in a simulated environment using headsets, gloves, and motion sensors, creating a deeply interactive virtual space. Augmented Reality (AR) differs from VR in that it overlays virtual elements onto the real world, allowing users to interact with digital content through smartphones, tablets, or AR glasses. Collaborative VR enables multiple users from different locations to interact in a shared virtual environment, either through avatars or 3D projections. Each of these VR types holds significant potential for educational applications, offering diverse ways to enhance learning through technology.

Current Applications in Indigenous VR

In addition, current applications of seated VR instruction are becoming increasingly popular in cultural learning, offering immersive and accessible experiences that enable students to explore diverse cultures, histories, and art forms from a seated position. Some notable examples of existing seated VR applications in cultural education include:

- Indigenous Cultural Experiences: Learners can immerse themselves in cultural VR environments such as the Sacred Spaces (Buhler, 2024), Our Worlds (OurWorlds, 2021; PBS SoCal, 2023), ImmersiveLink (ImmersiveLink, n.d.), Nishga BC (Johnson, 2020), Anishinaabe's River Manoomin (wild rice)(The Robertson Program, 2022; Young, 2024), learning an Indigenous Language (McDonald, 2023) like Blackfoot language (Condon, 2019) offering virtual experiences that expose them to Indigenous traditions, sacred sites, and cultural practices.
- Traditional Craft Workshops: VR is being used to teach traditional crafts, allowing students to virtually observe and participate in processes like weaving, pottery

making, or beadwork (Iron, 2023). This hands-on approach enhances both cultural understanding and skill development, offering a deeper connection to the craft and its cultural significance (Immersive Link, n.d.).

There are already impactful applications of VR being used to support Indigenous education, with a focus on cultural revitalization and language learning. As Condon (2019) describes, “VR is an empathy machine. The experience itself is very compelling, so the youth are really integrated into that process – it is extremely experiential” (para. 18). It allows people to step directly into someone else’s lived experience deepening understanding in ways traditional media cannot. This immersive quality allows learners to engage deeply with cultural practices and teachings. In the context of language preservation, Johnson (2020) highlights the motivational potential of VR in revitalizing Indigenous languages: “I see VR as one tool that can hopefully spark their imagination and their drive to either continue their language or begin learning – that one or the other” (para. 5). Platforms like Immersive Link (n.d.) have developed extensive libraries of Indigenous content, offering virtual experiences such as Making Deer Hoof Rattles, Canoe Building, Medicine Walks, Fireside Chats on Water Teachings, and Ojibwe Language Lessons. These digital environments are crafted in consultation with Indigenous knowledge keepers to ensure cultural accuracy and respect. As Young (2024) notes, “VR could be the key to teaching Indigenous ways of knowing—you can have a tribal elder teaching and talking to you on the land, and then you could be at your space with your peers and have a sacred fire also burning... and connect to that person” (para. 20). These examples demonstrate that VR is not only a technological tool but a bridge to

intergenerational learning and cultural continuity. With continued innovation and community collaboration, the possibilities for Indigenous VR education are expansive and deeply meaningful.

First vs. Third Person Perspectives

A non-immersive VR system, also referred to as desktop VR, offers an alternative to fully immersive, room-scale VR setups that require standing, walking, or physical interaction within a designated space. This configuration typically involves a standard computer and a monitor that display a three-dimensional virtual environment, allowing users to interact using traditional input devices such as a keyboard, mouse, or game controller. Despite its limitations - most notably the two-dimensional projection of a 3D space - non-immersive VR still provides valuable sensory feedback, including visual, auditory, haptic, and occasionally kinesthetic responses in real time (Chen, 2009). However, because the experience lacks spatial immersion, it may not evoke the same depth of presence or embodiment as fully immersive systems.

The sense of presence - the feeling of "being there" (Berti, 2021; Kober & Neuper, 2013; McLean, 2021) in a virtual environment – is a key component of effective VR experiences. This presence is influenced by multiple technological factors, including the field of view, tracking accuracy, stereoscopic rendering, and how the user's viewpoint is managed. Central to this is the camera perspective, which plays a significant role in shaping how users engage with and interpret the virtual environment.

A first-person perspective (1PP) positions the camera at the level of the avatar's eyes, allowing users to view and experience the virtual world as though they are

physically present within it (Gorisse et al, 2017). This viewpoint is widely used in VR gaming and immersive simulations due to its ability to foster embodiment – a psychological state in which users feel as though the virtual body is their own. Gorisse et al. (2017) argue that the 1PP creates the strongest conditions for inducing presence and self-identification in VR. Supporting this, Winn (1993) noted that first-person experiences are inherently subjective, direct, and often tacit, enabling users to engage with digital content on a deeply personal level.

In contrast, the third-person perspective (3PP) places the camera behind or above the user's avatar, allowing them to observe themselves navigating the virtual space - much like watching a character in a video game. While this perspective can reduce the feeling of embodiment, it increases situational awareness and can be useful in educational or observational contexts. Gorisse et al. (2017) describe third-person VR as a technique where the camera feed is displayed through the headset from a position external to the avatar, often located behind the user's virtual body. As Winn (1993) explains, interacting with a computer via an interface - typical of third-person setups - creates a perceptual boundary between the user and the virtual world, thereby distancing them from the experience.

Figure 3:

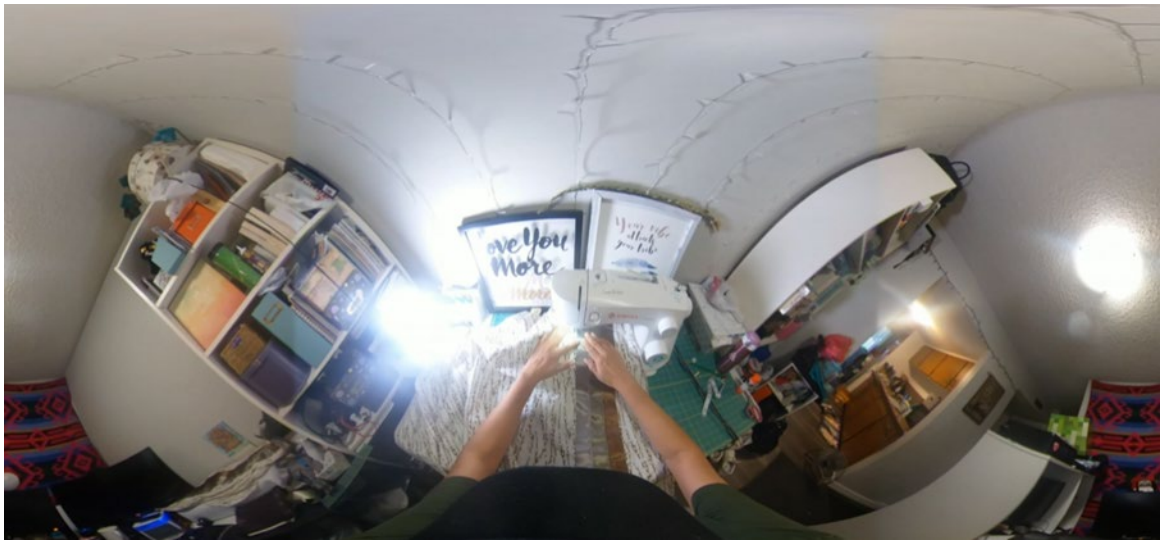
Third Person View

Note. Third Person View is the camera view from the side or above. You can see the character/person in the view and the environment around them. Observing their actions like a passive observer.

In my own VR project, I explored both camera perspectives while developing the instructional ribbon skirt-making video. Initially, I recorded from a 3PP (see Figure 3) using a camera positioned to the side of the activity. However, this approach created a sense of detachment from the learning process. After testing, I chose to mount the camera on my head, with a cap mount, replicating a 1PP (see Figure 4).

Figure 4

First Person View



Note. First Person View is viewing from the persons perspective; you are the person not a passive observer.

This shift significantly enhanced the viewer's sense of presence and immersion, allowing participants to experience the tutorial as if they were performing each step themselves. This adjustment reflects the importance of perspective in VR design, especially in educational contexts where embodiment and experiential learning are critical.

The purpose of this study is to investigate how immersive VR can facilitate the teaching and learning of Indigenous cultural skills - such as sewing a ribbon skirt - through the integration of Western educational frameworks and Indigenous epistemologies, particularly the concept of Etuaptmumk (Two-Eyed Seeing).

Two-Eyed Seeing

Etuaptmumk, or Two-Eyed Seeing, is a concept introduced by Mi'kmaq Elder Albert Marshall in 2012 (Integrative Science, n.d.). It is a guiding principle that encourages learners to draw on the strengths of both Western scientific ways of understanding the world and Indigenous ways of knowing. When these perspectives are used together – for the benefit of all – Elder Marshall describes the outcome as a "gift" cherished by many Indigenous peoples.

When I first encountered this concept, I began to notice how clearly it manifested in my own research, particularly when observing students who both watched the VR video and participated in sewing the ribbon skirt. They engaged with Western approaches to learning through written instructions and the use of mathematical measurements to determine the size of the skirt. At the same time, they learned through observation and hands-on practice, which is central to Indigenous teaching traditions. In sewing the ribbon skirt, they were drawing from the strengths of both knowledge systems.

In my project specifically, I included a mathematical formula for measuring the skirt (Nikki, 2022), along with a step-by-step set of written instructions (Appendix D) and diagrams showing how to lay the fabric, sew on the ribbons, attach the pockets, and stitch the sides together - an approach that reflects a distinctly Western instructional style. In contrast, when I learned to sew a ribbon skirt from the Elder in my community, she taught me simply by showing me. There were no measurements, no written steps - only demonstration and gentle guidance: "See, this is how it's done," she said, accompanied by the soft muttering of Cree words (Saddleback, 2023). Similarly, many of

the creators I observed on YouTube or TikTok teach in this same way: they rarely speak; instead, they demonstrate, and the learner must watch closely to follow along.

Through these experiences, the essence of Two-Eyed Seeing became clear honouring both structured Western methods and the embodied, experiential learning that is deeply rooted in Indigenous knowledge systems (Jeffrey et al., 2021).

In alignment with Indigenous research principles, relational trust became central to this project. Learning to sew a ribbon skirt relied on relationships of respect, reciprocity, and permission from community members who were willing to teach me, and incorporating VR into this process required further trust that cultural knowledge would be represented with care. As the project evolved, it became clear that trust formed the foundation of every stage – from the sharing of cultural teachings to the ethical use of technology for cultural learning. This research is not only about exploring VR as an educational medium; it is also about understanding how trust enables this kind of cultural-technology collaboration to occur responsibly. For these reasons, I ground my analysis in a theoretical lens of trust.

Chapter 3. Western Learning Theories

In exploring relevant theoretical frameworks, I focused primarily on Western learning theories that align with observable responses to repetition and feedback, such as Behaviorism (Main, 2023). I then turned to Constructivist theories (Aiello et al, 2012), which emphasize learner-centered approaches that build on prior knowledge and experiences - commonly referred to as “Learning by Doing” (Chen, 2009). Within this perspective, I considered several key concepts. First, I considered situation cognition (Aiello, 2012), which highlights learning through engagement in real-world contexts. Next, cognitive flexibility, where learners adapt by interacting with multiple representations of content. Then, neuroplasticity, the brain's ability to change in response to immersive experiences like VR, thereby making learning an active and dynamic process.

Another constructivist-aligned theory I examined was cognitive complexity, which suggests knowledge is constructed through interactions with one's environment. Building on this, the Cognitive Affective Model of Immersive Learning (CAMIL) (Makransky and Petersen, 2021) offers a comprehensive framework for understanding how learners process information in immersive environments. Closely related is the concept of Cognitive Presence (Riva, 2005), referring to the learner’s sense of “being there” in virtual environments – an important factor in engagement and knowledge construction. Finally, I considered Jaron’s Humanism and VR, a student-centered pedagogical approach that promotes self-discovery, critical thinking, and learner empowerment (Hutson, 2022; Lanier, n.d.; Microsoft, n.d.).

Behaviorism

Behaviorism is a learning theory centered on observable behavior changes that result from a learner's response to environmental stimuli. Rooted in the work of theorists like B.F. Skinner and John Watson, behaviorism emphasizes repetition, reinforcement, and conditioning (Main, 2023). In this model, learners are seen as passive recipients who acquire new behaviors through a system of rewards and punishments.

In the context of Virtual Reality, behaviorist principles are evident in structured, goal-oriented tasks where learners receive immediate feedback – either reinforcing correct responses or guiding correction of errors (Main, 2023). For example, VR applications used in vocational training (like aircraft simulation or CPR certification) often employ behaviorist techniques by segmenting tasks into discrete, repeatable steps that are mastered through repetition and feedback (Winn, 1993).

These principles apply directly to my ribbon skirt VR teaching module. In this project, I used a first-person VR video to guide learners through the step-by-step process of sewing a ribbon skirt. Each action – such as threading the needle, aligning fabric, or folding and stitching the ribbon – is demonstrated clearly and sequentially. Learners are encouraged to pause and repeat each step, mirroring the behaviorist technique of programmed instruction, where learners master one task before moving on to the next.

The video also incorporates visual cues to reinforce correct behaviors, such as highlighting the correct stitch placement or showing what a properly folded hem looks like. These elements serve as positive reinforcement, encouraging the learner to

emulate the demonstrated behavior. This kind of repetition and modeled behavior supports knowledge reproduction, a key outcome in behaviorist learning.

Although behaviorism may not fully support the deeper cultural understanding embedded in the tradition of ribbon skirt making, it is valuable for mastering the procedural and motor skills involved in the craft. By combining behaviorist methods with more holistic pedagogical approaches like constructivism or Two-Eyed Seeing, VR can offer both skill development and cultural immersion in a balanced way.

Constructivism

Constructivism is a learner-centered theory that posits that knowledge is actively constructed by the learner rather than passively received (Aiello et al., 2012). This theory suggests that individuals build on their existing knowledge and experiences to form new understanding. Learners actively engage with the world around them, seeking to make sense of new information by integrating it with what they already know. A key principle of constructivism is that learning is not simply about memorizing facts, but rather about engaging in meaningful, hands-on activities that allow learners to build and test their understanding in real-world contexts (Chen, 2009).

Social constructivism, a variant of this theory, emphasizes the role of social interaction in learning. In an online environment, this often means that learning is mediated through technologies that facilitate collaboration and interaction among learners (Bolduc & Simpson, 2020). This aligns perfectly with the nature of VR, which can provide immersive, interactive environments where learners not only engage with the material but also share experiences and learn from others.

For my ribbon skirt VR project, constructivism plays a vital role in how the experience is designed and delivered. In this virtual environment, learners are not passive recipients of knowledge but active participants in the process of creating a ribbon skirt. The VR environment allows them to experiment with fabric, thread, and sewing tools, mimicking real-world experiences where knowledge is built through trial and error. This aligns with the constructivist belief that learners construct knowledge more effectively through direct interaction and experimentation.

Learning-by-Doing in VR

The idea of learning-by-doing is central to Constructivist pedagogy (Aiello et al., 2012). In my VR experience, learners are not simply told how to sew a ribbon skirt; they are placed in a virtual environment where they actively engage with the materials and tools required to complete the task. This direct manipulation of virtual objects allows them to experiment with different techniques, adjust their actions, and experience the consequences of their choices. As they navigate through the VR environment, they refine their understanding of the process through hands-on involvement, creating new mental frameworks (or schemas) for sewing and cultural practices (Bartlett, 1932).

In addition to the active nature of the experience, the VR environment also encourages learners to connect new information with their prior knowledge, a key element of constructivist learning. Many learners may have some basic knowledge of sewing or cultural practices related to ribbon skirts, and the VR experience helps them build on this foundation by providing a space where they can apply and refine their

skills. This process is supported by the combination of sensory inputs (visual and tactile feedback) that guide the learner toward understanding the correct procedures.

Situated Cognition

The principles of situated cognition and anchored instruction are closely aligned with constructivism and are integral to the design of VR learning environments. Situated cognition emphasizes the importance of learning within the context of real-world situations. When learners engage in authentic, context-rich activities, they are more likely to transfer their learning to real-life scenarios. Anchored instruction further emphasizes using real-world problems or scenarios as "anchors" around which learning occurs, allowing learners to actively engage with material in meaningful ways (Barab et al., 1998).

In my VR project, the authentic cultural context of ribbon skirt making serves as an anchor for learning. The learner is not just acquiring technical skills but is also immersed in the cultural significance of the craft. Through hands-on engagement, they gain not only knowledge about how to create a ribbon skirt but also about its cultural context, history, and relevance. This situated learning environment fosters a deeper understanding of the skill, helping learners connect theoretical knowledge with its practical application.

Cognitive Flexibility

The Cognitive Flexibility Theory proposed by Spiro et al. (1991) suggests that learning complex material requires multiple representations – restructuring one's knowledge in many ways – and in an adaptive fashion. In the case of the ribbon skirt

project, this flexibility is necessary for learners to adapt the skills they acquire in the VR environment to different cultural or craft settings. For instance, learners may need to adjust the techniques they have learned based on different fabric types or cultural interpretations of ribbon skirts. The ability to apply the learned skills in diverse contexts is an essential aspect of cognitive flexibility.

The VR environment encourages this type of flexible thinking by allowing learners to explore multiple ways of creating a ribbon skirt, experimenting with different styles, designs, and techniques. By interacting with the environment in this way, learners develop a more nuanced understanding of the craft, enabling them to adapt their skills to a variety of situations.

Neuroplasticity

Research also suggests that immersive technologies like VR have the potential to stimulate neuroplastic changes in the brain, further supporting the constructivist idea that learning is an active, dynamic process (Ye et al., 2022). VR allows for highly interactive, hands-on learning experiences, which engage multiple senses and cognitive pathways. This type of learning has been shown to improve problem-solving, critical thinking, and active exploration skills (Ye et al., 2022). all essential for constructing new knowledge in complex domains.

In the case of the ribbon skirt project, the tactile interaction with virtual tools and materials enhances the learner's ability to process and integrate new information. Through repeated practice and engagement in the VR environment, learners build stronger neural connections related to the sewing process and cultural understanding,

increasing their ability to recall and apply this knowledge in future learning or real-world contexts.

Cognitive Complexity

The integration of Cognitive Complexity into the design of VR environments provides a rich framework for enhancing constructivist learning. Growing research on immersive learning environments demonstrates that VR is a powerful tool for knowledge construction, self-direction, and engagement (Dai et al., 2025). VR aligns well with constructivist principles, which assert that knowledge is constructed through the learner's interactions with their environment (Chen, 2009).

In the case of the ribbon skirt VR project, the design of the virtual environment supports active learning where learners are immersed in a task that allows them to learn by doing. This aligns perfectly with constructivist ideals, where learners not only passively receive information but are also actively engaged in creating, experimenting, and refining their knowledge through authentic experiences. In this case, learners actively construct their understanding of sewing techniques, cultural traditions, and design decisions while working within the VR environment, thereby developing new meaning through sensory inputs and cognitive processes.

Constructivism emphasizes learning through active, authentic, cooperative, and reflective learning activities, and VR provides a space where learners can engage in these practices. By enabling direct interaction with virtual tools (such as fabric, needles, and thread), learners engage in hands-on, authentic experiences that contribute to deeper learning (Chen, 2009). They don't just learn how to sew a ribbon skirt – they

learn by doing, navigating cultural traditions, and reflecting on their actions. As learners interact with these virtual objects, they build mental schemas that connect prior knowledge with new information, reinforcing the idea of learning as an active and dynamic process.

Criticism of the traditional, passive model of learning often highlights the lack of contextualized and interactive learning. VR addresses these concerns by offering environments where learners are not just observers but participants in an experience that mimics real-world scenarios (Chen, 2009). This active participation fosters greater engagement and a more profound understanding of complex tasks, such as the delicate process of ribbon skirt making, which requires attention to detail and cultural sensitivity.

Cognitive Affective Model of Immersive Learning (CAMIL)

The Cognitive Affective Model of Immersive Learning (CAMIL) offers a comprehensive framework for understanding how learners process information in immersive VR environments. CAMIL underscores the psychological aspects of VR, particularly the influence of presence (feeling as though you are truly in the virtual environment) and agency (having control over your actions) (Makransky & Petersen, 2021). In the ribbon skirt VR project, these factors are crucial because learners need to feel immersed in the process of sewing and designing, and they need to feel as though they can make choices and control the outcome.

The six factors of CAMIL – interest, motivation, self-efficacy, embodiment, cognitive load, and self-regulation – are particularly relevant for this VR project:

1. Interest: The cultural aspect of creating a ribbon skirt, an activity tied to personal heritage and tradition, ensures that learners are deeply engaged. Their interest in cultural practices provides a natural source of motivation.

2. Motivation: As learners engage with the virtual environment, their intrinsic motivation to learn how to sew a ribbon skirt is enhanced by the rich, hands-on experience that feels both meaningful and authentic.

3. Self-efficacy: By providing learners with immediate feedback in the VR environment, the project boosts their confidence in their abilities to complete the task. The VR environment allows for incremental success, where learners can improve through practice, thereby enhancing their belief in their own abilities.

4. Embodiment: In the VR experience, the learners feel physically connected to the task at hand, whether it's manipulating virtual thread or adjusting the pattern of the skirt. This embodiment connects their actions with their learning, making it feel more "real."

5. Cognitive Load: VR environments can manage cognitive load by presenting information in a structured, engaging manner, so learners aren't overwhelmed (Dai, et al.,2025). The task of creating a ribbon skirt in the VR world is designed to challenge learners without overwhelming them, helping them process the necessary information efficiently.

6. Self-regulation: The learner has the ability to monitor their progress and make adjustments in real time, whether it's adjusting a design element or selecting different

materials. This autonomy supports self-regulation, helping them take control of their learning experience.

By manipulating these cognitive and affective factors, VR can promote effective learning outcomes, especially in an environment designed for hands-on activities like ribbon skirt creation. CAMIL suggests that the more engaged learners feel and the more they have control over their actions, the more likely they are to retain the knowledge and skills gained in the VR experience (Makransky & Petersen, 2021).

Cognitive Presence

Cognitive Presence refers to thinking processes that you are physically located in the virtual environment, the learners' sense of being there. In the context of the ribbon skirt project, this presence is crucial for the learner's immersion into the cultural significance of the task. Cognitive presence arises when learners deeply engage with the VR environment, believing that it is a valid, albeit virtual, reality (Kober & Neuper, 2013). When learners experience the process of making a ribbon skirt in this way, they are not just learning a craft - they are living the cultural experience, reinforcing both the skills and the cultural knowledge embedded in the activity.

The immersive VR experience of ribbon skirt making provides learners with an authentic, contextualized teaching environment, mirroring real-world cultural practices. Researchers argue that immersive VR is particularly beneficial in connecting learners to real-world contexts - in this case, culturally significant practices that might otherwise be difficult to experience. VR allows for direct engagement with the materials and

techniques used in making a ribbon skirt, thereby helping learners appreciate the full context and significance of the practice.

For instance, ImmersiveLink (n.d.) emphasizes how VR storytelling in Indigenous culture - such as the creation of a ribbon skirt – bridges the gap between cultural tradition and technology, allowing learners to connect with their roots and deepen their understanding. By immersing learners in the tradition of ribbon skirt making, VR offers a pathway to gain not just technical skills, but cultural insight and appreciation.

This level of immersion and contextualized teaching produces a sense of "being there" (Berti, 2021), allowing learners to feel as though they are truly engaging in a cultural experience. This is where situated cognition comes into play: learning is not simply abstract; it's deeply rooted in the authentic environment in which it takes place.

The lessons from Cognitive Complexity, CAMIL, and Cognitive Presence have direct implications for the design of the ribbon skirt VR project. To create an effective, engaging experience for learners, the VR environment must be designed to foster presence, provide agency, manage cognitive load, and support self-regulation.

Additionally, the content must be culturally relevant and meaningful, helping learners connect their new skills to real-world cultural practices and their own experiences. By designing with these factors in mind, the VR experience can facilitate deeper learning, increase engagement, and provide learners with lasting knowledge they can apply beyond the virtual world.

Humanism

In the context of VR education, a humanistic approach places a strong emphasis on the learner's individual needs, autonomy, and personal growth. It is a student-centered pedagogy that encourages self-discovery, critical thinking, and empowerment, enabling learners to take ownership of their learning experience (Hutson, 2022). Rather than passively receiving information, students in a humanistic framework are active participants who engage deeply with the material in an immersive, interactive environment.

VR's potential to create personalized learning experiences that adapt to the learner's individual pace and preferences makes it an ideal tool for humanistic approaches in education. In such environments, learners are encouraged to think critically, reflect on their experiences, and develop a deeper understanding of the subject matter. The ribbon skirt VR project is an ideal example of how these humanistic principles can be applied to create an interactive, immersive, and personalized learning experience.

One of the most powerful strategies in a humanistic educational approach is experiential learning, which emphasizes the importance of hands-on experiences, real-world simulations, and active engagement with the learning material (Hutson, 2022). In the case of the ribbon skirt project, experiential learning is brought to life through the VR environment where students engage with the process of creating a ribbon skirt from start to finish.

Rather than simply reading about the steps of creating a ribbon skirt or watching a video, learners in the VR environment actively participate in each stage of the craft. This allows them to develop practical skills in sewing, design, and cultural

understanding, all while being immersed in a rich, interactive experience that goes beyond traditional learning methods. They don't just learn about the culture and significance of the ribbon skirt - they experience it firsthand.

The VR environment provides learners the opportunity to practice and experiment with sewing techniques, select materials, and even design their own ribbon skirt. This hands-on experience is key to experiential learning, where learners actively construct their own knowledge through trial, error, and reflection. The ability to explore different design choices, test out techniques, and receive immediate feedback supports the learner's autonomy, enabling them to make decisions that align with their cultural or creative vision.

In line with the humanistic approach, the ribbon skirt VR project also prioritizes personalized learning and self-discovery. Each learner's journey through the VR experience is unique, as they are encouraged to make choices about how they create their ribbon skirt, such as selecting fabrics, colors, and stitching patterns that are meaningful to them. This personalization fosters a sense of ownership over the learning process and promotes self-expression, which is a core value of humanistic education (Hutson, 2022).

The VR experience is designed to allow for self-directed learning where students can progress at their own pace. They are encouraged to experiment and make decisions that reflect their individual learning style and interests. This sense of control and agency over the learning process nurtures the learner's intrinsic motivation to continue exploring and refining their skills.

The humanistic approach also fosters critical thinking by encouraging students to reflect on their actions and decisions throughout the learning process (Lyu et. al., 2023). In the VR ribbon skirt project, learners are prompted to think critically about cultural symbolism, the significance of the ribbon skirt, and the choices they make as they engage with the project. For example, learners might be asked to reflect on the cultural importance of ribbon skirts in Indigenous communities or to think about how different design elements (like fabric choices or patterns) communicate meaning.

This reflective process promotes deeper understanding and allows learners to not only develop practical skills but also engage in critical inquiry about the traditions they are learning about. By encouraging students to think critically about their learning choices, the VR experience goes beyond mere skill-building and helps students appreciate the cultural and historical context of the craft.

A key element of humanistic teaching is the creation of a positive learning environment that fosters psychological safety, motivation, and well-being (Lyu et. al., 2023). The ribbon skirt VR project is designed to be an inclusive and supportive space where learners can make mistakes without judgment, experiment freely, and feel confident in their learning journey. The VR platform's immersive nature allows students to make errors in a low-risk environment and receive guidance as needed, which encourages a growth mindset.

Moreover, the VR setting fosters a sense of belonging and connection, particularly for learners from Indigenous communities who might find cultural significance and affirmation in the process of creating a ribbon skirt. The ability to engage with cultural

traditions in a virtual setting allows students to connect with their heritage in a meaningful way, reinforcing the importance of cultural identity in the learning process.

The ribbon skirt VR project provides an ideal space where learners can bridge the gap between virtual and real-world experiences. The project doesn't just simulate the act of making a ribbon skirt – it connects students to the real-world cultural significance of the practice. Through the VR experience, learners develop skills that can be transferred to the physical world, where they may choose to create actual ribbon skirts or share their knowledge and newfound skills with others in their community. In this way, VR serves as a catalyst for real-world action, deepening the learners' connection to the material and cultural traditions they are engaging with.

By applying a humanistic approach through experiential learning, the ribbon skirt project empowers learners to take control of their learning, think critically, and engage with cultural traditions in a meaningful and personal way. It emphasizes the learner's autonomy, enabling them to make choices that reflect their own cultural values and personal creativity. The hands-on nature of the VR experience ensures that learning is not just passive; it is active, reflective, and transformative (Lyu et. al, 2023). Ultimately, this approach helps students to not only acquire a new skill but also to connect deeply with the cultural significance behind the art of making a ribbon skirt.

Chapter 4. Methods for this Research

My research question –"How can immersive Virtual Reality (VR) support the teaching and learning of Indigenous cultural skills, such as sewing a ribbon skirt, through the integration of Western educational theories and Indigenous epistemologies like Etuaptmumk (Two-Eyed Seeing)?" – evolved significantly over time. Initially, the focus was broader: “Creation and investigation of virtual spaces for community learning and sharing.” While I did create a VR video intended for members of my community, a turning point came with the integration of Etuaptmumk, or Two-Eyed Seeing - an Indigenous epistemology that recognizes the strengths of both Western and Indigenous ways of knowing. This became a powerful lens for understanding what I was witnessing: participants drawing from both knowledge systems and finding balance between them. It felt like an epiphany – not just for me, but for the learners – who were embodying Two-Eyed Seeing by harmonizing Western Educational theories with Indigenous cultural teachings.

Research Methods

This study explored the potential of Virtual Reality as a learning tool for cultural skill acquisition, with a specific focus on ribbon skirt making. Through qualitative research methods, the study aimed to compare the effectiveness of VR-based learning to traditional instructor-led approaches, employing inductive reasoning – particularly generalization – to draw conclusions from a small sample of Indigenous participants. The investigation was that learners using a VR video would find the experience

innovative, immersive, and more interactive, due to its first-person perspective and lack of distractions.

Participants were observed as they engaged in the VR-based learning activity, and data were collected through a post-activity survey. The research took place in the Maskwacis community in Alberta, Canada, involving ten participants (nine women and one man), all aged 20 and above, with varying levels of familiarity with technology. Most participants had never used a VR headset before, making their initial interactions with the technology both insightful and, at times, humorous. Observations revealed a range of reactions, particularly from those less comfortable with technology, some of whom expressed initial fear or hesitation.

The mixed-methods approach included qualitative observation during the VR sessions and quantitative data collection via an anonymous survey distributed through SurveyMonkey. Participants completed their ribbon skirts using both VR guidance and written instructions before receiving the survey link via email. To ensure data reliability, analysis commenced only after at least ten surveys had been submitted.

Unexpected logistical challenges impacted the study timeline. Originally scheduled to be conducted at a local college, the research had to be relocated after the facility was closed due to a roof collapse caused by spring thaw moisture. As a result, sessions were held in participants' homes – including the researcher's – which extended the data collection period over several months, from summer into fall. While this adjustment limited the ability to work with larger groups, it allowed for more in-depth, one-on-one engagement.

Ethical Considerations

Despite the challenges, the study demonstrated the promise of VR as an educational tool in cultural contexts. Participants generally found the experience engaging, with many indicating that VR provided a more immersive and interactive way to learn. These insights suggest that, when implemented respectfully and ethically, VR has the potential to support the preservation and transmission of traditional knowledge. There are two ethical considerations OCAP and EDI that will be discussed next.

Ethical considerations were integral to the study, particularly adherence to the Indigenous principles of OCAP® (Ownership, Control, Access, and Possession). These principles guided all aspects of data handling to ensure that the Maskwacis community-maintained sovereignty over their knowledge. Survey responses were anonymous, data were stored temporarily, and findings were not shared outside the research process. Guided by the Elders of my community in Maskwacis my research asks: “How can immersive Virtual Reality (VR) support the teaching and learning of Indigenous cultural skills, such as sewing a ribbon skirt, through the integration of Western educational theories and Indigenous epistemologies like Etuaptmumk (Two-Eyed Seeing)?”

OCAP principles - Ownership, Control, Access, and Possession

The OCAP principles - Ownership, Control, Access, and Possession - are fundamental to ensuring that Indigenous communities maintain sovereignty over their data and knowledge. These principles guide the ethical management of research and knowledge sharing, especially when it comes to cultural practices and traditional knowledge (FNIGC, 2024).

Ownership refers to the fundamental right of the community to claim and protect the information that pertains to them. In the context of the Maskwacis community, ownership means that the knowledge and cultural practices, such as the making of ribbon skirts, belong to the community itself. This ownership extends to all forms of knowledge, from traditional practices to modern adaptations, ensuring that the community holds the authority over how their cultural information is shared, used, and disseminated.

As a member of the Maskwacis community conducting this research, I understand the importance of respecting the community's ownership of its cultural knowledge. The data I collected for this research, including the survey responses and interviews, are part of the community's knowledge base, and it is my responsibility to honor that ownership. I am committed to ensuring that the information I gather is treated with respect and only used in a way that aligns with the values and consent of the community. Furthermore, all participants in my study were fully informed and voluntarily agreed to take part, with the assurance of anonymity. This respect for ownership is not just about legal rights but about maintaining the dignity and cultural integrity of the Maskwacis people.

Control is the second key principle in the OCAP framework, emphasizing that the community retains full authority over the data and research processes that involve their cultural knowledge. This principle ensures that Indigenous communities can determine how their information is collected, analyzed, and used. In my research, control means that the community of Maskwacis, through its members, maintains the authority over

all aspects of the research process, from data collection to how the findings are disseminated.

I chose to focus on the traditional knowledge of ribbon skirt making for this study, and while the research uses this knowledge, I am mindful that the community already shares this practice widely, especially through online platforms like Facebook, Instagram, and TikTok. This wide dissemination indicates that the community has a level of control over how this knowledge is shared publicly. However, by engaging with the community through interviews and surveys, I have respected their right to control how this knowledge is represented in my work. In the context of my research, I ensure that the community has a voice in how their knowledge is used and that no aspect of the research is conducted without their input and consent.

Access refers to the right of the community to have ownership of their own data and to make decisions about how that data is accessed by others. This principle ensures that Indigenous communities have control over who can access the information and under what conditions. For the Maskwacis community, access means that they have the right to view, manage, and make decisions about any information related to their culture, history, and traditions, including data collected through research.

In my project, I have made the information I collect available in a way that respects the community's right to access. The VR video I created, which serves as both an educational tool and a form of cultural expression, has been uploaded to YouTube for public access. This aligns with the principle of access, as the video VRwAVO (meaning VR with Audio Voice Over) on my YouTube channel Twylla Soosay at

https://www.youtube.com/watch?v=YwUiqIsAZnU can be viewed by anyone, including members of the Maskwacis community, who may choose to engage with the content.

However, it is important to note that when using the appropriate TK Labels, the one fitting here is Tradional Creative (TK: CR) Knowledge, which states: This Label is being used to acknowledge the relationship between the creative practices of Twylla Soosay and Maskwacis community and the associated cultural responsibilities. From the Local Contexts.org site it defines this as TK-Creative, “This Label should be used when an individual artist or author would like to clearly connect creative practices with traditional knowledge deriving from their own community. While an individual artist or author has standard copyright and creative commons licenses available to use, this Label helps make clear that a creative practice is also deeply connected to a collective responsibility around the use and sharing of traditional knowledge” (Local Contexts, 2024). While the video is publicly accessible, the community retains the authority to decide how their cultural knowledge is presented and shared, ensuring access is in line with their values and interests. Additionally, the survey data I collected, the interviews I conducted will only be used for the purposes of this research and will remain anonymous, ensuring that participants' identities and personal information are protected.

Possession refers to the physical control and safeguarding of data. This principle emphasizes the community's ability to assert ownership and protection over the physical and digital data collected about them. In my research, possession means that the data collected will be stored on the Athabasca University (AU) secure cloud as per

AU research ethics requirements. The anonymity of the participants in my study guarantees that no personal information is linked to the collected data, preserving the integrity of their involvement.

While I am the steward of the data, I recognize that the Maskwacis community holds ultimate possession over the cultural knowledge shared within the research. This principle also applies to the way the findings are shared. The only records of the research data will exist in my thesis and the YouTube video, both of which are publicly available. In this way, I am ensuring that the data does not belong to me personally, but rather to the community, who can access and decide how it is shared. The control and protection of this data are paramount, and I will continue to safeguard it in line with the ethical responsibilities outlined by the OCAP principles.

The principles of Ownership, Control, Access, and Possession are vital in guiding the ethical management of Indigenous knowledge in research. In the context of my study, I am deeply committed to upholding these principles to ensure that the cultural knowledge of the Maskwacis community is respected, protected, and shared in a way that aligns with the community's values. By adhering to these principles, I aim to honor the Maskwacis community's sovereignty over their cultural practices, while also ensuring that the research is conducted in a transparent, respectful, and culturally sensitive manner. Through this process, I hope to contribute to the ongoing dialogue around the importance of ethical research practices and the role of technology in preserving and sharing Indigenous knowledge.

Equity, Diversity, and Inclusion (EDI)

Applying Equity, Diversity and Inclusion (EDI) principles to Virtual Reality is essential to ensure that immersive technologies serve all learners fairly and respectfully. Scholars such as Boudreau & Anis (2024), emphasize the need for EDI training and awareness to meet the diverse needs of individuals. VR is the ideal medium for supporting EDI because it provides a shared immersive experience while still allowing for flexible implementation, cultural sensitivity, and multiple pathways to access learning.

Equitable access means providing learning opportunities that accommodate different abilities, backgrounds, and learning preferences. In this project, accessibility was central to the design. Some learners struggle with written instructions, so a VR video was used to provide a clear visual and experiential explanation of the process. Additionally, the VR experience was made accessible through a tablet for participants who could not wear a VR headset, ensuring no one was excluded because of physical discomfort, disability, or preference. This aligns with VR best practices emphasizing universal design, flexible access points, and multimodal learning support.

A key EDI principle in VR development is ensuring that immersive experiences are culturally respectful - especially when working with Indigenous communities. For this project, cultural sensitivity was paramount. Collaboration with Elder Saddleback (2023) provided guidance on what teachings could be shared and what content remained sacred and community specific. Respecting these boundaries ensured that the VR experience remained aligned with Indigenous knowledge protocols

Additionally, the learning environment was designed to acknowledge the potential emotional impact of Western-style educational settings on Indigenous learners, many of whom have experienced historical trauma in schools. The VR video incorporated elements such as a drumbeat soundscape to create a calming, culturally grounded atmosphere, supporting a decolonizing approach that centers Indigenous well-being and comfort.

Diversity in participation enriches VR-based learning and research. This project included volunteers from a wide range of backgrounds, which strengthened the relevance and inclusivity of the experience. Such diversity helps counteract the underrepresentation of marginalized groups – including Indigenous peoples, low-income individuals, and those with varying literacy levels – in research and educational innovation.

By designing the methodology to welcome and support this diversity, the project ensured that everyone - regardless of socioeconomic status, cultural identity, or prior educational experience - could fully participate. This aligns with EDI principles emphasizing representation, inclusive design, and reducing systemic barriers (Singha, 2023).

Across all stages of the VR implementation, EDI principles shaped decisions around access, cultural respect, representation, and learner-centered design. VR's immersive nature - combined with intentional EDI integration - created an experience that was accessible, inclusive, culturally responsive, and equitable for all participants.

This approach demonstrates how VR can support diverse learners while honoring the unique perspectives and needs of Indigenous communities.

Observations

The goal of this portion of the study was to explore the cultural significance of the ribbon skirt and to understand how technology, specifically VR, can enhance the learning process for creating these garments. As the ribbon skirt holds deep cultural meaning, it is worn for various ceremonies, powwows, weddings, funerals, and even everyday occasions by those who take pride in their heritage. I wanted to give participants an opportunity to learn how to make a ribbon skirt through an immersive VR experience, complemented by written instructions and diagrams to cater to different learning styles. This combination aimed to create a multi-sensory learning experience that would enhance both understanding and retention of the skill.

When I first considered the idea of making a ribbon skirt, I wanted to understand the cultural significance behind it. I learned that the ribbon skirt is worn for many important occasions, such as ceremonies, powwow dancing, weddings, funerals, and wakes (Saddleback, 2023). Over time, it has become increasingly common for people to wear ribbon skirts for everyday outings as a symbol of pride in their heritage. This inspired me to teach others how to make a ribbon skirt, starting with a VR video that would create an immersive experience, followed by a set of written instructions with diagrams to support different learning styles. Many people find it easier to learn not only through reading but also by seeing visual representations, and in this case, the VR video was crucial in helping participants visualize the process.

The participants in the study had varying levels of experience. Some had made ribbon skirts before, while for others, it was their first time. I wanted to enhance their learning experience by offering a sensory element through the VR video. To achieve this, I recorded the grand entry of our local powwow - a powerful moment when multiple drum groups take turns welcoming participants to the event. I felt it was important for the participants to feel a sense of belonging and pride, while simultaneously learning how the ribbon skirt is made. The combination of visual and auditory cues provided a more immersive and meaningful experience.

The learning outcomes for basic sewing skills, such as those involved in making a ribbon skirt, were enhanced by this multi-sensory approach, which addressed the participants' unique learning needs (Ereje, 2020). In particular, the integration of both verbal and visual signals catered to the more traditional Western-style approach to learning, while the use of virtual reality helped optimize the experience by engaging multiple senses. People rarely learn through only one sense; instead, they gain knowledge through a combination of sensory inputs. By incorporating various senses, the aim was to create an experience that would lead to deeper, more lasting learning. According to Edgar Dale’s "Cone of Experience," learners retain 90% of information through "action learning," which involves sensory-based, perceptual learning styles (Ereje, 2020). The more senses that are engaged in the learning process, the greater the likelihood of retention.

Data Collection

The participant group in this study was intentionally diverse. It included young mothers, senior women, a son making a ribbon skirt for his mother, and recently graduated youth from high school. Each came from different cultural and educational backgrounds, and their perspectives on using technology for learning varied accordingly. Some participants were enthusiastic about the opportunity to try a VR headset for the first time, while others were more hesitant – especially those who wore glasses. One participant expressed concern about potential eye strain, so I provided the option of viewing the VR video on a tablet instead. Only one participant wanted to use this alternative.

For the pilot study, a sample size of ten participants was selected as a small but representative group. ArborXR (2024) recommends aiming for ten to twenty participants with a range of skill levels for VR pilot testing, as this size is manageable and reduces strain on resources. With only one VR headset available, a group of ten allowed for a more efficient learning session and provided ample opportunity to observe participant behaviour, comfort levels, and ease of use.

Participant Consent

I introduced the project to participants as an instructional resource combining VR video instruction and written step-by-step instructions (Appendix D). This dual approach was a critical element of the hypothesis: to test whether participants could integrate both their Western instructional background and their Indigenous lens while learning the cultural skill of making a ribbon skirt.

Instruments and VR Video

The core equipment utilized for this project included a Ricoh Theta V 360-degree camera mounted on a specialized cap, an iPad for wireless video transfer, and an Oculus headset (as well as an iPad tablet) for viewing the final VR experience.

Creating the VR video involved significant technical research. The Ricoh Theta V requires specific software to process its raw footage. Initial recording was done by connecting the camera via Bluetooth to the iPad, which produced a fish-eye lens video format.

The primary technical hurdle was converting this footage into the required equirectangular format for 360-degree viewing. I discovered that I needed an archived version of the Ricoh software, a challenge that necessitated joining a Ricoh message board for troubleshooting. After receiving the necessary legacy software from the community, I was successfully able to stitch the raw video files into the correct format, resolving the issue caused by using an older camera model.

Once the video was in the proper equirectangular format, I imported it into Adobe Premiere Pro for editing. The raw footage consisted of various snippets detailing the step-by-step process of creating a Ribbon Skirt. The editing process involved:

- Initial Assembly: Cutting and splicing the footage, aiming for a final runtime of 5-8 minutes.

- Audio Production: The original audio was removed and replaced with intertribal music sourced from our community pow-wow. I then wrote out a script and recorded a voice-over to describe the steps of the skirt-making process.
- Video Orientation: A crucial adjustment was tilting the video within Adobe Premiere. Because the camera was mounted high on a head-cap, the original perspective did not adequately show the sewing details. Learning to re-orient the video corrected this viewing angle.
- The final video was exported directly to a dedicated YouTube channel using the software's built-in functionality. I chose the Oculus headset specifically for its ability to flawlessly view 360-degree videos directly from YouTube, eliminating the need for complex custom apps. The video was successfully tested on the Oculus headset, confirming its readiness to be shown to participants before their sewing session.
- Participants were given two options for viewing the video: 1) VR Headset: To watch the 360-degree instructional video. 2)Tablet: Provided as an alternative viewing method for any participant who might experience VR discomfort (e.g., dizziness or nausea).

Survey

When I first began thinking about the survey, I knew that it was going to be completed anonymously, having done previous surveys in other classes I found SurveyMonkey to be user friendly. Formulating the questions I had to think about what I

wanted to find out. I knew that incorporating both Western and Two-Eyed Seeing were the two main ideas I wanted to ask about. There was also a negative feeling of VR sickness, so I knew I had to ask about any discomfort from watching the video. Then I knew I wanted their opinion on how VR could be used to learn other cultural skills. Once I had the questions (Appendix B) Survey Monkey's survey procedures were quite simple to enter the question and determine the scale of answers the participants could answer. To do the survey I had given them the tablet which had the browser and link to Survey Monkey and my survey questions. To ensure a consistent initial dataset, I waited until ten surveys were completed before exporting the results into Excel for analysis. To analyze the results, I first compiled the participant responses into a detailed table. I then created a bar graph to visualize the distribution of these answers. This set the stage for the final step: a thematic comparison to see how the theoretical pedagogies were reflected in the participants' feedback.

The survey (Appendix B) consisted of nine questions designed to gather qualitative feedback on participants' experiences with the VR instructional video. A combination of open-ended questions and close-ended items (e.g., yes/no, scaled responses) was used to elicit both measurable feedback and more reflective, narrative responses. Open-ended questions encouraged participants to share their personal impressions, cultural insights, and learning preferences in their own words, which aligned with the Indigenous participant-centered methodology of this study. The questions were intentionally framed in accessible language to support diverse literacy levels and ensure cultural appropriateness. Responses were analyzed thematically to

explore how participants engaged with the VR learning experience and how their feedback reflected the integration of Indigenous and Western pedagogical knowledge systems.

The survey analysis reveals how immersive VR can serve as a powerful medium for culturally responsive learning, especially when informed by both Indigenous and Western pedagogical frameworks. Through sensory immersion, narrative design, and careful integration of traditional knowledge, the experience resonated with participants across diverse educational backgrounds. These findings reinforce the value of Etuaptmumk (Two-Eyed Seeing) in guiding instructional design and highlight the importance of creating flexible, inclusive learning environments that honor cultural knowledge systems.

I clearly explained the purpose of the research: to assess the utility and effectiveness of VR technology in learning traditional cultural skills. Participants were informed that after completing the task (watching the video and making the skirt), they would be asked to provide anonymous feedback by completing a project survey. I ensured all participants understood the confidentiality protocols:

- Anonymity: The feedback provided in the survey would be completely anonymous and not linked back to their individual identity.
- Data Collection: I explained that I would be collecting a total of ten responses and would not analyze the survey results until all ten participants had completed the process.

All participants provided their consent and proceeded to complete the survey following the skirt-making process.

Chapter 5. Results and Data Analysis

The following section presents an analysis of the survey questions designed to assess participants' experiences with the immersive Virtual Reality VR instructional video. Each question was carefully developed to explore key elements of the learning experience, such as immersion, emotional and sensory engagement, cultural relevance, and learning preferences. Grounded in the theoretical framework of Etuaptmumk (Two-Eyed Seeing), the questions aimed to examine the integration of Indigenous and Western pedagogical approaches, with specific attention to how participants perceived and interacted with the learning environment. The responses offer insight into how immersive technologies can support culturally responsive education, while also highlighting practical considerations such as accessibility, cognitive load, and learner well-being.

Results of the Survey

These are just the initial results as they appeared when I exported the data into excel. I wanted to highlight the results into each singular question. After Table 1 of these results, I will explain the intent behind the question as it pertains to my research.

Table 1:

Tabulated Results of the Survey

Q1: Do you consent to do this survey?

Yes	10
No	0

Q2: Did you find the Virtual Reality (VR) video immersive? (For example, I felt like I was making the skirt with the presenter, taking the steps with her.)

Strongly Agree	4
Agree	6
Neither Agree nor Disagree	0

Disagree	0
Strongly Disagree	0

Q3: Did the soundscape improve the experience? Was it helpful?

Strongly Agree	5
Agree	5
Neither agree or disagree	0
Disagree	0
Strongly Disagree	0

Q4: Did you find the experience unique or innovative way to learn?

Strongly Agree	9
Agree	1
Neither Agree or Disagree	0
Disagree	0
Strongly Disagree	0

Q5: Did you find this VR experience caused you to be disoriented, nauseous or dizzy?

Strongly Agree	0
Agree	1
Neither Agree or Disagree	4
Disagree	4
Strongly Disagree	1

Q6: Did the written instructions help? (For example, did reading the written instructions before you watched the video help you understand the task?)

Extremely helpful	3
Very helpful	6
Somewhat helpful	1
Not so helpful	0
Not at all helpful	0

Q7: What type of learning experiences are you used to?

Western instruction/Written Instruction	2
Indigenous/practical/visual watching instruction	5
No preference	0
Both	3

Q8: Which do you prefer to learn?

Western Instruction/Written Instruction	0
Indigenous/practical/visual watching instruction	7
No preference	1

Both	2

Q9: Where could you see this approach of VR instruction be used?

Science: How your blood works? How food is digested?	0
Language: Conversational Cree. Learning French	3
Cultural Knowledge: Drum making, Dance outfit making, learning how to dance traditional.	8
Learning a skill: Cooking chicken noodle soup. Learning how to make an electrical outlet	4

Note. This table shows the number of responses to each question in the survey.

Analysis of the Survey

Q1: Do you consent to do this survey?

The initial question was designed exclusively to secure informed consent from participants prior to their completion of the survey.

Q2: Did you find the Virtual Reality (VR) video immersive? (e.g., "I felt like I was making the skirt with the presenter, taking the steps with her.")

The main question I wanted to explore was whether the VR video felt immersive. Significant attention was given to refining the audio design, particularly the inclusion of a steady drumbeat, which served both cultural and cognitive functions. The intention behind the audio was to create a rhythmic soundscape, to help participants enter an Indigenous mindset. The drumbeat, mimicking a heartbeat, was designed to evoke connection to their Indigenous heritage creating the Indigenous learning atmosphere. Participants were also encouraged to explore the 360-degree environment. This was important because focus is essential for learning, but also being able to engage with the task at hand was a key aspect of the experience. Additionally, I wanted them to observe the everyday environment, people walking around and pets present. This setting was

deliberately chosen to create comfort, familiarity, and authenticity, which are hallmarks of experiential and situated learning.

Q3: Did the soundscape improve the experience? Was it helpful?

This question probed the impact of audio elements on learning engagement. The drumbeat, as a culturally resonant sound, was expected to promote relaxation and attentiveness. From an Indigenous perspective, the drum functions as both spiritual and pedagogical, reinforcing a rhythm that learners can internalize. Literature also suggests that soundscapes in VR can mitigate symptoms of VR sickness (Blue, 2021), which was an added consideration. Responses to this question highlighted the importance of sensory integration in immersive learning design.

Q4: Did you find the experience unique or innovative way to learn?

This question assessed participants' openness to alternative learning methods. Many noted that this VR-based instruction felt novel and distinct from traditional learning environments. As immersive VR remains a relatively new educational tool, especially in cultural skill transmission, the participants' positive reception suggests strong potential for broader pedagogical application. Their responses affirmed that VR could provide deeply engaging, culturally meaningful learning experiences.

Q5: Did you find this VR experience caused you to be disoriented, nauseous or dizzy?

This question addressed the common concern of VR-induced motion sickness. Most participants did not report discomfort; however, this concern remains relevant, particularly for longer or more dynamic experiences. The researcher's personal experience with VR sickness during the production process - caused by a hardware issue

- underscored the importance of technical quality and controlled video length to prevent negative physical reactions.

Q6: Did the written instructions help? (e.g., did reading the written instructions before you watched the video help you understand the task?)

This question explored multimodal learning, particularly the integration of written (Western) and visual/embodied (Indigenous) instructional styles. The principle of Etuaptmumk (Two-Eyed Seeing) encourages drawing on the strengths of both systems (Jeffrey et al., 2021). Participants who had been educated in public schools – where written instructions are standard – may have found these materials more useful. This reflects the importance of designing inclusive content that acknowledges varied literacy backgrounds and educational experiences.

The researcher's own schooling journey – from residential school to public school – provided additional context for understanding how written instruction intersects with personal and cultural identity. These lived experiences inform the significance of developing teaching materials that are both accessible and culturally respectful.

Q7: What type of learning experiences are you used to?

This question sought to uncover participants' prior exposure to different educational systems. Responses varied widely, including public schooling, homeschooling, and informal cultural education. These backgrounds shape how participants engage with learning content, particularly in culturally specific contexts.

Recognizing these diverse learning histories is crucial for implementing truly inclusive and responsive pedagogy.

Q8: Which do you prefer to learn?

The next question I asked participants was about how they believe they learn best, what they prefer. Many people are already aware of their learning preferences, often through personal experience. Here, participants reflected on their learning preferences. Many identified a blend of methods – visual, auditory, and written – as most effective. This supports the Two-Eyed Seeing approach, as learners unconsciously integrate Western and Indigenous methodologies. The blending of modalities – doing, watching, listening, and reading – contributes to more holistic learning outcomes.

Q9: Where could you see this approach of VR instruction be used?

Finally, I asked where participants could see this VR approach being used. To guide their responses, I provided examples of VR videos I had encountered during my research. This final question encouraged participants to imagine the future applications of VR instruction. Many favored cultural learning contexts, possibly influenced by the content of the current experience. Still, their responses revealed an intuitive recognition of VR's potential for culturally grounded, experiential learning. The question also raised valuable inquiry into whether their enthusiasm was shaped more by content or by cultural affinity.

Data analysis of Learning a Cultural Skill

Learning about theory involves understanding concepts based on evidence, facts, laws, and hypotheses. In contrast, learning a cultural skill is often linked to cultural

competence, which is a lifelong process of developing cultural awareness. It involves gaining knowledge and a deeper understanding of one's own culture, which in turn fosters greater self-awareness (Guzman et al., 2016). When combined with theoretical knowledge, learning a cultural skill becomes more profound and can take time to develop into full competence. However, cultural competence does not always require mastery; it can simply mean respecting and recognizing the significance of cultural knowledge. Ultimately, cultural competence is the ability to understand, appreciate, and effectively engage with people from diverse backgrounds.

Analysis using Theoretical Pedagogies

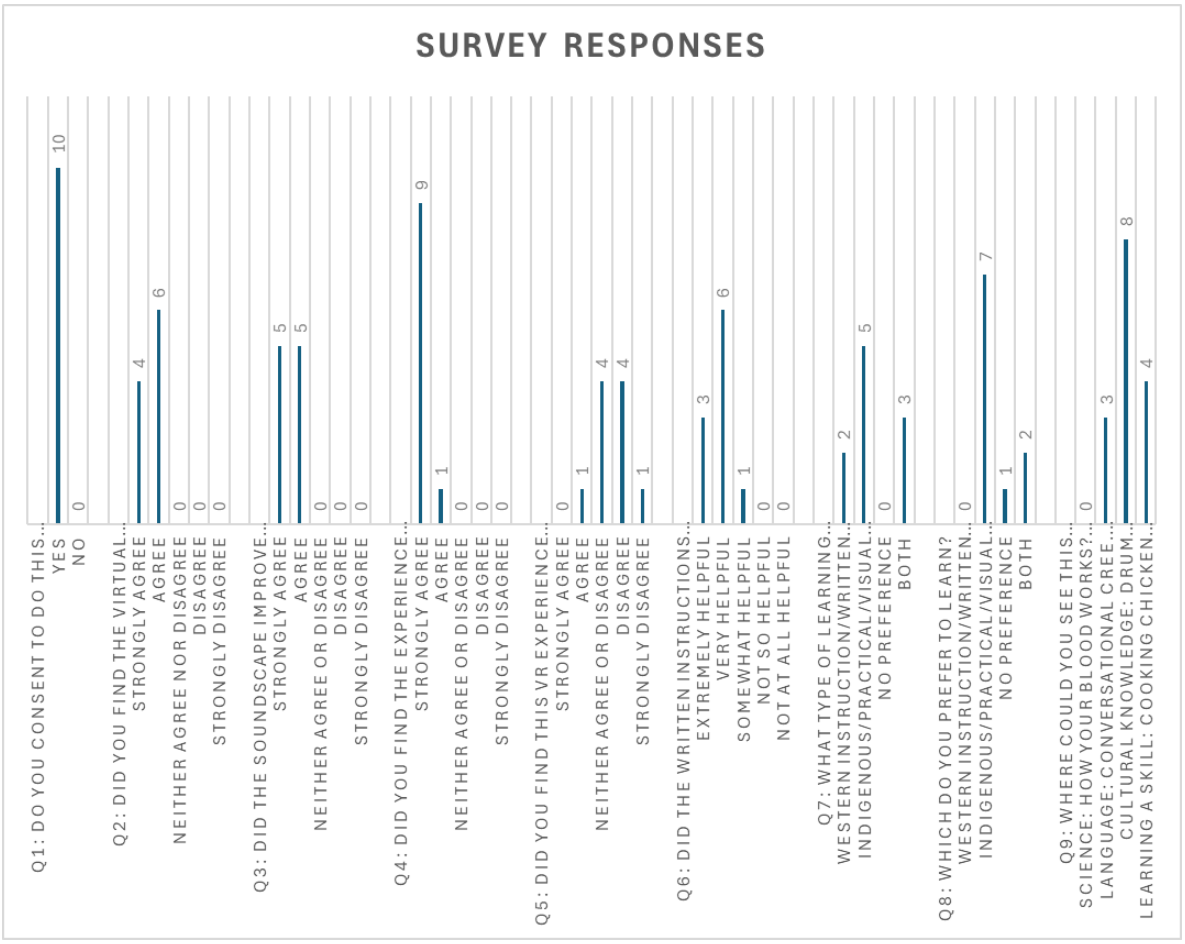
The survey question about learning preferences is closely tied to cultural competence, which involves behaviors such as active listening, empathy, and effective engagement in cultural awareness. Learning preferences refer to how individuals acquire knowledge and develop self-awareness. Active listening requires avoiding mental distractions and staying focused on the task at hand. Empathy entails understanding and connecting with another person’s perspective, while effective engagement is about learning from one another. The activity of watching me teach the learner how to sew encompasses all these elements, as it encourages active listening, fosters empathy, and promotes collaborative learning. When analysing the questions, I decided to look at them from a bar-graph perspective see Graph 1. After plotting the responses for Questions 1–9, I noticed some Graph 1: Bar Graph of Results (Questions 2 – 6)

clear patterns. For Questions 2, 3, and 4, “agree” and “strongly agree” were the most common answers. Question 5 was designed to identify whether participants experienced VR sickness, but most respondents were unsure, selecting “neither agree nor disagree,” “disagree,” or “strongly disagree.”

Questions 6 and 7 produced more predictable results, likely because the participants were already familiar with a Western style of teaching and therefore found the instructions “extremely helpful” or “very helpful.” Question 8, however, was surprising: despite their positive responses in Questions 6 and 7, none of the participants indicated a preference for Western instruction. Finally, Question 9 aimed to gather their opinions on the types of VR instruction they would like to see or experience.

Graph 1:

Bar Graph of Results



Note. This was to visually see which questions got the most responses.

Next, I was looking at all their responses from all the survey respondents see Table 2. The survey results reveal several notable trends regarding participants' experiences with the VR activity. Responses to Questions 2, 3, and 4 were overwhelmingly positive, with the majority of participants selecting "Agree" or "Strongly Agree," indicating a generally favourable perception of the VR environment and its effectiveness. Question 5 showed considerable uncertainty surrounding VR sickness, as most participants selected "Neither agree nor disagree," "Disagree," or "Strongly

disagree," suggesting that VR sickness was not a prominent issue or was difficult for participants to identify. Questions 6 and 7 received consistently high ratings, with participants describing the instructions as "Very helpful" or "Extremely helpful," demonstrating that the instructional elements were clear and supportive. Interestingly, despite these positive evaluations, responses to Question 8 indicated a strong preference for Indigenous, practical, or visual forms of instruction over Western-style instruction, with no participants selecting the latter exclusively. This suggests a meaningful alignment between participants' learning preferences and culturally relevant or hands-on instructional approaches. Finally, Question 9 highlighted participants' interests in future VR content, with themes such as cultural knowledge, language learning, and skill development emerging as prominent areas of engagement.

Table 2:

Table of Results (Questions 1-9)

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Yes	Strongly Agree	Strongly Agree	Strongly Agree	Neither Agree nor disagree	Very helpful	Both	Indigenous/ practical/ visual	Cultural Knowledge
Yes	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Disagree	Very helpful	Indigenous/ practical/ visual	Indigenous/ practical/ visual	Cultural Knowledge
Yes	Agree	Strongly Agree	Strongly Agree	Disagree	Extremely helpful	Indigenous/ practical/ visual	Indigenous/ practical/ visual	Cultural Knowledge
Yes	Strongly Agree	Strongly Agree	Strongly Agree	Neither Agree nor disagree	Extremely helpful	Both	Both	Learning a skill
Yes	Agree	Agree	Strongly Agree	Disagree	Very helpful	Both	Both	Language, Cultural Knowledge, Learning a Skill
Yes	Agree	Agree	Agree	Neither Agree nor disagree	Very helpful	Indigenous/ practical/ visual	Indigenous/ practical/ visual	Language, Cultural Knowledge

Yes	Agree	Agree	Strongly Agree	Disagree	Very helpful	Indigenous/ practical/ visual	Indigenous/ practical/ visual	Language, Cultural Knowledge, Learning a Skill
Yes	Strongly Agree	Strongly Agree	Strongly Agree	Disagree	Extremely helpful	Western instruction/ written instruction	Indigenous/ practical/ visual	Cultural Knowledge
Yes	Agree	Agree	Strongly Agree	Agree	Very helpful	Indigenous/ practical/ visual	Indigenous/ practical/ visual	Learning a skill
Yes	Agree	Agree	Strongly Agree	Neither Agree nor disagree	Somewhat helpful	Western instruction/ written instruction	No preference	Cultural Knowledge

Note: Each participant response for each question, in no particular order.

Collectively, these findings suggest that while participants responded positively to the overall VR experience, they exhibit clear preferences for instructional approaches that emphasize cultural relevance, experiential learning, and practical application.

To better illustrate how participants' survey responses align with relevant learning theories, Table 3 presents each question alongside the primary theoretical frameworks that help explain the observed patterns. The table highlights how learners engaged with VR through multiple dimensions: cognitive, affective, cultural, and experiential. Behaviourist principles were evident in responses related to instruction clarity and structure, while constructivist and humanistic frameworks explain learners' meaning-making, agency, and preferences for culturally relevant experiences. Situated cognition, CAMIL, and cognitive presence capture the immersive and context-rich nature of VR learning, and cognitive flexibility and neuroplasticity reflect participants' adaptability to novel and sensory-rich environments. Notably, Two-Eyed Seeing is

included where learners demonstrated the integration of dual perspectives, valuing both Western instructional methods and culturally grounded, experiential approaches. Together, this table provides a comprehensive view of how each survey question connects to established learning theories, setting the stage for deeper discussion of the findings.

This next table was based in a theory-informed interpretation of the survey results by linking each question to a specific learning theory or instructional framework. This approach was to provide insight into why participants responded as they did and how their responses aligned with broader educational perspectives.

Table 3:

Table of Survey Questions, Focus Area, Learning Theory/Framework and Key Insights

Question	**Focus Area**	**Learning Theory / Framework**	**Key Insight**
Q1	Informed Consent	Ethical Research Practice	Ensured voluntary, informed participation.
Q2	Immersion in VR	Situated Cognition; CAMIL; Cognitive Presence; Neuroplasticity	Participants felt immersed; VR environment created meaningful, authentic learning contexts.
Q3	Audio & Engagement	Constructivism; Cognitive Flexibility; CAMIL	Sensory cues (drumbeat) indicate high engagement of learners actively interacting with VR stimuli and tasks.
Q4	Innovation	Cognitive Flexibility; Neuroplasticity; CAMIL	Positive responses show adaptation to new sensory experiences and willingness to explore.
Q5	VR Sickness	Cognitive Load Theory; UX/Usability; CAMIL; Embodied Cognition	Hardware stability, and video length are crucial but low discomfort suggests manageable cognitive load.
Q6	Written Instructions	Behaviorism; Constructivism	Structured guidance helped learners navigate VR; supports through repetition and feedback.

Q7	Learning Background	Cultural-Historical Theory; Humanism; Constructivism; Two-Eyed Seeing	Prior experience shaped understanding and comfort; learners valued both Western and culturally grounded approaches.
Q8	Preferred Method	Constructivism; Situated Cognition; Humanism; Two-Eyed Seeing	Learners preferred culturally relevant instruction despite rating Western instruction as helpful.
Q9	Application of VR	Constructivism; Humanism; Situated Cognition; CAMIL; Cognitive Presence; Two-Eyed Seeing	Participants want VR content that is culturally meaningful, skill-based, and immersive; emphasizes learner agency and dual pedagogical perspectives.

Note. This table is a summary of the themes of which the question poses. It also shows the learning theory each question relates to, and any insight into the theory.

Table 3 reveals a strong coherence between participants responses and established theories such as behaviourism, constructivism, situated cognition, cognitive flexibility, cognitive complexity, CAMIL, cognitive presence, neuroplasticity, and humanism. In particular, Q2 had positive responses to immersion of situated learning, where authentic sensory engagement enhanced the understanding. Engagement with audio elements, Q3 aligns with embodied and affective learning, suggesting that sensory components like the drumbeat support emotional and cognitive involvement. Preferences for Indigenous/practical/visual methods, Q8 strongly reflect Two-Eyed Seeing, indicating that learners prefer approaches integrating both cultural and experiential knowledge systems.

Analysis using a Theoretical Lens of Trust

When designing the survey questions for this study, I realized that my exploration of virtual reality VR as a tool for teaching cultural skills could not be easily measured through traditional scientific methods. The purpose of the questions was not

to collect objective, quantifiable data but to understand the participants' personal experiences with learning – a skill that holds deep cultural significance. The focus of the survey was to explore how learning a cultural skill, like making a ribbon skirt, is not just about acquiring a new technique but also about connecting to one's identity and cultural pride. For many in the Maskwacis community, this act of learning is closely tied to their heritage, and it symbolizes a deep sense of belonging and pride in their people. The learning process is often shaped by the theory of learning by doing, which emphasizes hands-on, experiential engagement with the material, as well as learning through instructions. Both approaches – learning by doing and learning by reading instructions – can play critical roles in teaching a cultural skill.

Learning by doing is rooted in experiential learning theory, which posits that people learn best when they actively engage in an experience, reflect on it, and then apply the knowledge gained in real-world contexts. This hands-on approach contrasts with more Western learning methods, which may focus on passive absorption of information. Experiential learning is about more than simply performing a task; it's about the reflection that comes afterward and the application of those reflections to make decisions or take further action. According to the University of Alberta, experiential learning empowers learners by encouraging them to experiment, investigate, problem-solve, collaborate, and create (University of Alberta, 2024). This method is particularly valuable when learning complex or culturally significant skills, as it enables learners to make connections between their personal experiences and the material being taught. The process also fosters a stronger connection between the

learner and their community, reinforcing the sense of belonging and shared cultural identity.

In the Maskwacis community, where making ribbon skirts is an important cultural practice, I have observed how deeply this process impacts the individuals involved. Many women in the community take great pride in the ribbon skirts they create, viewing them not only as garments but as representations of their cultural heritage. These skirts are worn with pride during powwows and other cultural ceremonies, and the women often share excitedly with each other about when and where they will wear their skirts. This sense of cultural pride and belonging is a critical element of the learning process, and it is something that transcends the mechanics of sewing or crafting. The pride in creating these garments goes beyond the act of making them; it's an embodiment of cultural competence and identity (Duckhee et.al., 2023). This emotional connection highlights the importance of experiential learning, where the act of learning itself is intertwined with the learner's personal and cultural identity. The act of making a ribbon skirt, then, becomes not only an educational experience but also a meaningful cultural practice that strengthens connections to both the community and one's heritage.

Ethical Considerations

I spoke of ethical considerations in the methods section but in this context of the analysis I am considering cultural sensitivity, and privilege. This phase of analysis was focusing on being objective, reporting on the findings and ensuring the data disclosed is

in its original form. Part of this is to be mindful of avoiding bias but being honest and these two ethical considerations are important in this part of the research.

Cultural Sensitivity and Privilege

When collecting data within my own community, I had to be mindful of how this information would be used and analyzed by other researchers and educators. Cultural sensitivity and privilege are deeply intertwined in the context of learning Indigenous cultural skills, such as the traditional art of ribbon skirt making. Individuals from dominant or settler cultures often have greater access to educational resources, funding, and platforms where Indigenous skills can be learned or displayed. This privilege can unintentionally lead to cultural appropriation – benefiting from a culture without permission or understanding its significance – rather than fostering respectful engagement (Indigenous Corporate Training, 2020).

Cultural sensitivity requires more than respect; it calls for humility and a deep understanding that Indigenous knowledge is often sacred, ancestral wisdom rooted in lived experience, identity, and sovereignty. Engaging with this knowledge responsibly necessitates seeking permission, building trust, and appreciating the cultural and historical contexts in which it exists. During this research, I consulted with an Elder who expressed concern about how their teachings would be represented: *"*Will you be writing all that I say in your thesis?" (Saddleback, 2023). I reassured them that their guidance was sought solely to inform my personal understanding and that the teachings shared were specific to the process of making a ribbon skirt. Out of respect for their wishes and cultural protocol, their words were not recorded or reproduced in full.

The Merriam-Webster dictionary defines privilege as a right or immunity granted as a particular benefit, advantage, or favor (Merriam-Webster, 2024). Historically, Indigenous peoples have been denied many privileges, including the right to preserve and pass on traditional knowledge. In the context of this project, I sought to offer participants a form of privilege by providing them with the opportunity to engage in the creation of a cultural artifact. Through the process of making ribbon skirts, participants were able to connect with a practice of deep cultural significance. The VR instructional video played a crucial role in guiding them step-by-step, providing an immersive, hands-on approach that allowed them to learn not just the craft, but also to forge a deeper connection to their culture.

Indigenous communities have long experienced cultural suppression, where their traditions were outlawed or devalued. When non-Indigenous individuals learn and share these traditions without acknowledging this history – or when they profit from it – it can perpetuate historical injustices. Privilege can be used responsibly by amplifying Indigenous voices, supporting Indigenous-led teaching, and ensuring that the learning process centers the community and culture, rather than the outsider. Furthermore, Kairos (2025) free, prior and informed consent (FPIC) is an inherent right of Indigenous peoples and helps ensure their survival, dignity and well being.

Data Sovereignty and Culture Revitalization

Data sovereignty and cultural revitalization are crucial, and these two concepts often go hand-in-hand in Indigenous contexts. Indigenous data sovereignty means that Indigenous communities have the right to govern the collection, ownership and

determine how their own cultural data be used. Many Indigenous nations have rules about who can share what, when, and with whom – these are based on values, not just legal systems. It is important as a researcher to engage in Free, Prior, and Informed Consent (FPIC) before collecting or using cultural knowledge (Kairos Canada, 2025).

Licensing tools like the Traditional Knowledge (TK) Labels help indicate how cultural knowledge should or shouldn't be used. (Local Contexts, 2024). Specifically, the label TK Creative is the one I felt most represented this research project. I am using the creative VR Video as an individual artist or author where I am connecting the traditional knowledge derived from my own community by the art of the ribbon skirt. I am also recognizing that this creative practice I am also responsible for the use and sharing of this traditional knowledge.

Cultural revitalization aims to restore what colonization attempted to erase – language, ceremony, practices, and more. Protection of values is a concern because it requires careful thought and ongoing consideration (Mills & Regenbrecht, 2023). Protecting what is sacred is itself a form of revitalization – it honors the knowledge holders and keeps cultural integrity intact. While data sovereignty protects how and by whom cultural knowledge is shared, revitalization is about why and for whom that knowledge lives on. When both are respected, Indigenous cultures can thrive without being extracted or misused.

Anonymous Elder Interviews

After the survey, it was suggested that elders in the community be interviewed to gather their perspectives on the new VR technology. The interviews were held

anonymous and would focus on several key areas: its effectiveness as a learning tool, their thoughts on integrating both Western and Indigenous approaches to teaching, their overall impressions of using VR, and whether they believe it is appropriate for use within the community.

Several responses indicated that the elders appreciated the use of virtual reality for teaching how to make a ribbon skirt, recognizing its potential as an engaging and innovative instructional tool. One individual expressed enthusiasm, stating, "I really want to make myself a skirt," indicating a personal connection to the video content and an eagerness to engage with the learning process. Others recognized the value of VR, noting that it is an effective tool for attracting younger learners. As one elder remarked, "This type of instruction is needed to keep the young people interested. They will find it cool!" This highlights the potential of VR to engage a generation that is more tech-savvy and accustomed to digital interactions.

However, some practical concerns were raised. An elder pointed out, "Not everyone has access to a VR," suggesting that while VR can be an effective teaching tool, its accessibility may be limited for certain community members. This reflects a gap in technological resources, which could hinder the widespread adoption of VR-based learning within the community. Moreover, the suggestion to add "a few close-ups to demonstrate some instructions" indicates a desire for more detailed, clearer instructions within the VR format, which can enhance the learning experience for those less familiar with the technology.

The concept of "Two-Eyed Seeing," which integrates both Western and Indigenous approaches to teaching, was positively received. After I explained to them the theoretical pedagogy, the responses to the question about whether VR could support this concept were largely supportive, with one elder saying, "Yes, using technology is the future and should be part of teaching." This reflects an openness to blending modern technology with traditional Indigenous knowledge systems. Another elder noted, "I can see how using both the strengths of Indigenous teachings and western teaching can help you grasp the concept of learning how to do something cultural." This indicates recognition of the value of merging both learning styles to provide a more holistic and inclusive educational experience.

However, there was a cautionary note: "I just hope students can understand that not one is better than the other." This response suggests the importance of maintaining respect for both systems of knowledge. It acknowledges that while technology can enhance learning, it should not overshadow or replace the traditional methods that are deeply rooted in cultural practices. This response shows a desire for balance, ensuring that both forms of knowledge are valued equally.

When discussing whether VR technology is appropriate for the community, there was a consensus that it could be effective, especially in engaging younger generations. One elder said, "Kids these days love technology. They grasp it better than us old people," emphasizing how younger people are more adept at using modern technology. This reflects the generational divide in comfort with technology but also shows an

acknowledgment of the need to adapt traditional teaching methods to the preferences and capabilities of younger learners.

However, there was also a practical concern raised regarding potential VR-related issues, such as "VR sickness." This demonstrates a need to be cautious and mindful of potential physical side effects, which could limit the effectiveness of VR for some users. Additionally, an elder expressed regret about the lack of VR technology in their own education, stating, "I wish I had this technology when I was going to school." This sentiment reflects both a longing for more advanced educational tools in the past and an appreciation for how such technology can now improve learning experiences.

The concept of open education – sharing knowledge freely and openly – was met with a variety of opinions. One elder knew that the sharing of ribbon skirt knowledge is already happening informally on platforms like Facebook and TikTok, suggesting that "it should be taught openly" because the cultural knowledge is already being shared. This response highlights the growing trend of cultural knowledge being shared through social media, indicating that open education is becoming increasingly normalized, particularly through social media platforms. In addition, open education resources should be transformative, reshape traditional paradigms, foster an inclusive and accessible learning environment (Coolidge, 2024).

On the other hand, there was a more cautious response regarding open knowledge sharing, with one elder expressing, "I hate to give anyone power over us (pause)... it should just be shared with our own people." This reflects a concern about cultural appropriation and the control of Indigenous knowledge. It underscores the

desire to safeguard cultural teachings and traditions within the community and maintain ownership over them. The balance between openness and protection of cultural heritage is a critical concern, and this response indicates a preference for restricting access to certain knowledge to ensure it is shared within the community, rather than publicly.

Chapter 6. Discussion

After the analysis, distinct key insights began to emerge. One of the most notable was the participants' engagement with the technology. The concept of "Two-Eyed Seeing" resonated strongly with many of them, as they had experienced Western education – often imposed upon them – while still holding on to their Indigenous teachings and knowledge. Another insight was the community's view on open education; some felt that it may be too open, particularly when it comes to sharing sacred or culturally sensitive teachings.

Sovereignty

The First Nations Information Governance Centre (FNIGC) highlights that data sovereignty takes on various forms, shaped by the diverse worldviews, protocols, systems, sciences, and theories of data and information that exist within Indigenous communities (FNIGC, 2024). Indigenous data sovereignty extends beyond mere ownership; it encompasses the self-determined management, interpretation, and application of information in alignment with community values and traditions. Because research and data collection profoundly impact First Nations, these processes must be grounded in local cultural protocols and community governance structures.

The University of Alberta further defines data sovereignty as the management of information that is in harmony with the laws, practices, and customs of the community (University of Alberta, 2024). This perspective acknowledges that the ways in which data is collected, shared, and used must be consistent with Indigenous knowledge systems and cultural protocols, rather than being dictated by external, often colonial, frameworks. In this way, data sovereignty is about ensuring that communities retain control over their own knowledge and the right to decide how their data is used or shared. As mentioned earlier the TK labels have to be considered when sharing data (Local Contexts, 2024).

As I embarked on this project, I sought guidance from an elder to deepen my understanding of the cultural significance of the ribbon skirt within our community, especially over the past two to three decades. Growing up, I remember seeing plain skirts worn during ceremonies, but over time, the ribbon skirt has become a more prominent symbol. I wanted to know why this change occurred and what the ribbon skirt represented within our culture. This inquiry was purely for my own personal understanding, as I sought to grasp the deeper meaning behind this cultural artifact.

When I approached the elder, I was met with a strong and clear response: she expressed that the knowledge regarding the significance of the ribbon skirt should remain within the community and should not be shared with outsiders. She made it clear that this knowledge is part of our history, our cultural identity, and our collective data – it belongs to us, and it is a crucial element of our cultural sovereignty. This was a profound reminder of the importance of respecting cultural protocols, especially when it

comes to sacred traditional knowledge (Local Contexts, 2024). By honoring her request not to share the reasons behind the significance of the ribbon skirt, I was upholding the principles of data sovereignty, which protect and preserve the sacredness of our traditions.

Through this experience, I came to better understand how data sovereignty operates within our community. It is not just about protecting information but about ensuring that our cultural knowledge remains intact and undisturbed by external forces. It reinforced the idea that some knowledge is meant to be shared within the community, and the decision to make it accessible to others is a choice that belongs solely to the community members. This is a critical aspect of our cultural survival and empowerment, and it is why protocols surrounding our data must always be respected and protected.

Culture Revitalization

When I mentioned that it is only within the past twenty to thirty years that we have begun to wear ribbon skirts openly, I am referring to a larger cultural shift that coincides with significant changes in both society and technology. This period overlaps with the rise of the Internet and mass media, which have played a pivotal role in facilitating open communication and the sharing of information. The increased connectivity allowed Indigenous people to reclaim, celebrate, and share their cultural practices in ways that were not possible before. The broader dissemination of information through social media platforms and online communities has helped amplify

Indigenous voices, connecting people across regions and generations. Camosun College in Victoria, B.C. is an example of using VR to help the process by inviting people to contribute what sounds of a culture mean to them, by using sounds of languages being spoken that were lost or almost lost in Residential Schools (Matte, 2023). The visibility of cultural practices, including the creation and wearing of ribbon skirts, became a form of self-expression and resistance to cultural erasure.

This resurgence also coincides with a larger societal shift in Canada, particularly with the recognition by the Canadian government of the historical and ongoing impacts of the Residential School system on Indigenous peoples. The Truth and Reconciliation Commission (TRC), established in 2008, sought to address the harm done by the residential schools and the legacy of colonialism, urging for reconciliation and a better understanding of Indigenous histories and experiences (Government of Canada, 2024). In 2024, the TRC's calls to action continue to resonate, emphasizing the need for Indigenous peoples to be respected, their voices heard, and their experiences acknowledged. This period of recognition and healing has allowed for a deeper reflection on Indigenous identity and pride, leading to a cultural revival where practices, such as making and wearing ribbon skirts, are seen not just as acts of tradition, but as acts of resilience and empowerment.

Adding to this momentum, the establishment of National Ribbon Skirt Day, which began in 2023, further highlighted the significance of the ribbon skirt as a symbol of Indigenous identity, cultural pride, and resistance (Sheppard, 2023). This day serves as an opportunity to honor and celebrate the powerful cultural practice of ribbon skirt-

making, allowing Indigenous people to share their stories, their craftsmanship, and the meaning behind the ribbon skirt itself. This national recognition has contributed to the growing visibility of the ribbon skirt as both a cultural artifact and a form of personal and collective expression.

All these factors: the rise of social media, the government's acknowledgment of Indigenous experiences through the TRC, and the recognition of National Ribbon Skirt Day have contributed to the widespread resurgence of ribbon skirt creation in Indigenous communities. As more people make and wear ribbon skirts, they increasingly share their creations on social media platforms like Facebook, Instagram, and TikTok, whether to showcase their craftsmanship, preserve cultural heritage, or promote their work for sale. This movement has sparked a sense of pride and solidarity within Indigenous communities, where the act of wearing a ribbon skirt is not only a personal statement but a collective one, a visible sign of cultural revitalization, pride, and resilience.

Theoretical Survey Discussion

To further this discussion, this chapter presents the key findings from the survey and discusses their alignment with the theoretical frameworks introduced in Chapter 3. This examines participant responses across Questions 1–9 and integrates behaviourism, constructivism, situated cognition, cognitive flexibility, neuroplasticity, cognitive complexity, CAMIL, cognitive presence, and humanistic pedagogy to interpret how learners engaged with the VR experience.

Immersion, Engagement and Presence

Across Questions 2, 3, and 4, participants consistently reported high levels of immersion and engagement. These findings align strongly with situated cognition (Barab et al., 1998), which posits that learning is enhanced when embedded within authentic, context-rich environments. The sensory elements—particularly the drumbeat—were repeatedly noted as grounding and focusing, reflecting principles of embodied cognition and the affective dimensions of the Cognitive Affective Model of Immersive Learning (CAMIL).

The strong positive response to the innovative nature of VR (Q4) suggests that participants adapted effectively to unfamiliar technological experiences, demonstrating cognitive flexibility (Spiro et. al., 1991). According to this theory, learners benefit from interacting with multiple forms of representation; VR enables this through spatial, visual, auditory, and cultural modalities. This also reflects elements of neuroplasticity, (Ye et al., 2022) as immersive environments actively stimulate the brain through novel sensory input.

The sense of "being there" reported by participants corresponds directly to Cognitive Presence (Kober & Neuper, 2013), highlighting that the virtual environment created a meaningful psychological and cognitive space for learning. Such presence is a foundational indicator of effective immersive learning.

Instruction, Guidance, and Learner Orientation (Q6 – Q7)

Participants reported that written and verbal instructions were "Very helpful" or "Extremely helpful" (Q6–Q7). This aligns with behaviourist principles, where clear,

structured guidance and repetition establish predictable learning pathways (Main, 2023). The clarity and sequencing of instructions functioned as external cues that shaped learner behaviour and reduced disorientation within the VR environment.

Yet, participants' responses also reflect deeper constructivist principles (Chen, 2009). While behavioural scaffolding provided structure, participants relied on their prior experiences and educational histories to interpret and navigate the VR experience (Main, 2023). This aligns with cultural-historical activity theory and humanistic learning theory, both of which emphasize the importance of learner background, identity, and personal meaning-making in shaping educational outcomes (Hutson, 2022). Participants' familiarity with Western instruction facilitated comprehension, but it did not determine their preferences, as illustrated by responses to Question 8.

Cognitive Load, Comfort, and User Experience (Q5)

Question 5 explored whether participants experienced VR sickness. Most responses indicated uncertainty ("Neither agree nor disagree") or lack of discomfort ("Disagree" or "Strongly disagree"). Interpreting these findings through Cognitive Load Theory, the results suggest that the VR experience did not impose excessive sensory or cognitive burden (Dai, et. al, 2025). Minimal discomfort also reflects effective UX design elements, supporting the view that the interface and experiential flow were generally stable and manageable.

Within CAMIL, learner comfort is located at the intersection of cognitive load and emotional response. The absence of significant VR sickness indicates that the cognitive–affective threshold remained balanced, enabling learners to engage

meaningfully with the environment without overwhelming sensory mismatch (Makransky & Petersen, 2021).

Cultural and Instructional Preferences (Q8)

Despite rating Western-style instructions as helpful (Q6–Q7), participants overwhelmingly preferred Indigenous/practical/visual instruction when asked about their actual learning preference (Q8). This finding demonstrates the importance of constructivism, where learners favour context-rich, experiential engagement over passive information delivery (Chen, 2009).

The preference for culturally grounded methods aligns strongly with situated cognition, which emphasizes the authenticity of learning within real-world or culturally relevant contexts (Barab et al., 1998). It also reflects humanistic pedagogy, in which learner identity, autonomy, and cultural relevance shape learning motivation and satisfaction (Hutson, 2022).

This pattern also illustrates the principles of Two-Eyed Seeing, where learners appreciate the clarity of Western instruction but see greater value in Indigenous or community-based learning approaches that resonate with their lived experiences.

Desired VR Learning Experiences (Q9)

Question 9 revealed strong interest in future VR applications related to cultural knowledge, language learning, and practical skill development. These preferences map directly onto constructivist principles (Chen, 2009), demonstrating learners' desire to build knowledge through meaningful, hands-on, culturally grounded activity.

The emphasis on culture and skills also aligns with situated cognition, as learners desire VR experiences that reflect authentic community contexts rather than abstract academic scenarios (Barab et al., 1998). This further reflects humanistic learning theory, which emphasizes intrinsic motivation, personal growth, and identity development as central drivers of educational engagement (Hutson, 2022).

Additionally, these preferences engage the contextual and affective dimensions of CAMIL, as culturally relevant VR design is more likely to evoke emotional resonance and sustained cognitive engagement (Makransky & Petersen, 2021). VR environments that mirror community practices may also heighten Cognitive Presence, allowing learners to feel more grounded and invested in the virtual space (Kober & Neuper, 2013).

Overall, the survey findings demonstrate strong coherence with the theoretical frameworks outlined in the literature review. First was Behaviourism, which helps explains the effectiveness of structured instructions. Constructivism is what interprets how learners construct meaning through culturally grounded VR experiences. Situated Cognition is evident in participants' preference for real-world cultural contexts. Cognitive Flexibility appears in the positive response to innovation and adaptive engagement. Cognitive Load Theory contextualizes the minimal VR sickness reported. CAMIL explains the interplay of cognitive, emotional, and contextual factors in immersive learning. Cognitive Presence is supported by high levels of immersion and engagement. Humanism emerges strongly in learner preferences for culturally meaningful, self-directed VR content. Two-Eyed Seeing highlights learners' ability to

integrate dual perspectives: appreciating the structure and clarity of Western instructional methods while valuing culturally relevant, experiential learning approaches. Together, these frameworks reveal that participants engaged with VR in ways that were cognitive, affective, cultural, and experiential, demonstrating VR's potential as a culturally responsive learning tool that balances multiple pedagogical paradigms.

Chapter 7. Conclusion

Initially, my research was to expand my knowledge on virtual reality (VR). I did not expect the cultural identity disconnection I had experienced just when creating a ribbon skirt. I had unknowingly hidden my identity crisis not knowing my culture, not knowing the protocols of asking for knowledge, and also not realizing how easy that information, seeking that support of learning about my cultural roots was. It did not begin with a sense of pride in one's culture and instead it moved from cultural loss to a cultural resurgence and understanding. This shows how resilient our culture is, and our knowledge keepers share their knowledge willingly once you have properly offered the cultural protocol and showed a willingness to learn.

While VR offers powerful, immersive ways to explore history and traditions, it does have significant limitations when used for cultural teaching. These challenges range from ethical concerns and difficulty incorporating VR technology, to analyzing multiple theoretical pedagogies, cultural sensitivity (OPAC, EDI), financial accessibility, and embracing VR as a tool rather than a replacement, as well as Indigenous pedagogy (Two-Eyed Seeing). Through the elders' interviews and counsel, we helped determine a path forward by utilizing VR technology in cultural teachings, maintaining a balance between Western technological strengths and Indigenous ways of knowing/doing, especially involving the community (Wright et al, 2019).

There is also an opportunity to look at the issues of the technology, learning how to bridge the gap between the "what" (VR technology) ad the "how" (Indigenous pedagogy). VR can be a powerful tool for cultural revitalization but there is a lack of

empirical research regarding its implementation in the education system. Currently there is no widely accepted theoretical framework for VR in education (Berti, 2021). There needs to be more research to ensure the technology is used effectively and ethically. But there is a pedagogical bridge with the integration of Two-Eyed Seeing by balancing Indigenous ways of knowing with Western technological strengths.

The integration of VR into cultural education represents a significant shift in pedagogical practice, moving from passive observation to active, multidimensional engagement. As demonstrated by the survey findings, the success of this medium is deeply rooted in several core learning theories. From a behavioural perspective, the structured clarity of the technology provides a necessary foundation, while constructivism and situation cognition empower learners to build meaningful, authentic, culturally grounded environments. Furthermore, the application of Two-eyed Seeing reveals a unique capability of VR: the ability to bridge Western instructional precision with the holistic, experiential nature of Indigenous ways of knowing.

However, the potential of VR as a culturally responsive tool is not without its constraints. While Cognitive Load Theory and the CAMIL model suggest that immersion can enhance emotional and cognitive presence, these benefits are contingent upon the ethical and technical integrity of the content. The limitations – to the loss of tactile, sensory nuance – reminds us that VR is a supplement to, rather than a replacement for, the living transmission of culture. For humans to truly flourish in a virtual space, the learner's self-directed journey must be supported by authentic authorship and community-led design.

Ultimately, this study suggests that when VR is being developed through a cultural lens and theoretical framework, it transcends being more than a mere “gadget” and becomes a transformative bridge. By balancing the “two eyes” of technological innovation and traditional wisdom, educators can harness the power of immersive learning to preserve and share cultural teachings in ways that are cognitively sound, affectively resonant, and ethically responsible.

This research functions as a community-based pilot that adheres to OCAP principles by ensuring that Indigenous knowledge remains under the control and ownership of the Maskwacis people. While technical barriers and the high cost of VR equipment present significant EDI challenges – regarding financial accessibility – this study serves as a culturally responsive bridge. It acknowledges that while VR can simulate the visual act of ribbon skirt making, it remains a supplementary tool that must be grounded in the equity of hands-on teaching to truly be effective.

Finally, the participation of the Maskwacis community suggests that while VR is a welcomed innovation for engaging the youth, it must operate under a framework of cultural protectionism. The elders concluded that digital accessibility must not supersede the OCAP principles of Ownership and Control. In this context, VR is not a space where technology facilitates an introduction to culture, but the deepest teachings should remain guarded as sacred practices of the community.

Possible Directions for Future Research

Based on the analysis and the principles of Two-Eyed Seeing (Etuaptmumk), these recommendations serve as a roadmap for bridging the gap between Western technological strength and Indigenous/cultural integrity. An established cultural advisory circle must be established in the Maskwacis community that includes Elders/Knowledge keepers at the onset. This supports Human-centric approaches by prioritizing community-identified goals, ensuring the content is self-directed by the culture it represents. This will help strengthen how community creation of VR content strengthens cultural ownership, trust, and engagement. There could be a long-term cultural involvement in the community to continue this reconnection to their culture.

Finally, there can be trust-centred outcomes that examine how immersive cultural VR influences emotional connection, cultural pride, or the learners' sense of belonging. This could also include deeper exploration of trust, how it is built, maintained or challenged through digital cultural teaching.

In conclusion, while there is enthusiasm for using technology like VR in educational settings, particularly for younger generations, the community is mindful of the challenges it presents, especially regarding access and the preservation of cultural integrity. The elders' responses emphasize a balance between embracing modern tools and maintaining respect for traditional ways of learning and teaching.

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APPENDIX A: Athabasca University Research Ethics Approval

Athabasca University

CERTIFICATION OF ETHICAL APPROVAL

The Athabasca university Research Ethics Board (Rea) has reviewed and approved the research project noted below. The REB is constituted and operates in accordance with the current version of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2) and Athabasca university policy and procedures.

Ethics File No.: 25701

Principal Investigator:
Ms. Twylla Soosay, Graduate Student
Faculty of Science & Technology\Master of Science in Information Systems (MSclS)

Supervisor/proiect Team:
Dr. Stella George (Supervisor)

Proiect Title:
Creation and investigation of virtual spaces for community leaming and sharing

Effective Date: June 1 7, 2024 **Expiry Date**: June 16, 2025

Restrictions:

Any modification/amendment to the approved research must be submitted to the AUREB for approval prior to proceeding.

Any adverse event or incidental findings must be reported to the AUREB as soon as possible, for review.

Ethical approval is valid for a period of one year. An annual request for renewal must be submitted and approved by the above expiry date if a project is ongoing beyond one year.

An Ethics Final Report must be submitted when the research is complete (*i.e. al/ participant contact and data collection is concluded, no follow-up with participants is anticipated and findings have been made available/provided to participants (if applicable))* or the research is terminated.

Approved by: **Date**: **June 17, 2024**

Oscar Lin, Chair
School of Computing & Information Systems, Departmental Ethics Review Committee

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Athabasca University Research Ethics Board
University Research Services Office
1 University Drive, Athabasca AB Canada T9S 3A3
E-mail rebsec@athabascau.ca
Telephone: 780.213.2033

APPENDIX B: Survey Questions

1. Do you consent to this survey? Yes ◯ No ◯
2. Did you find the Virtual Reality (VR) video immersive?

(For example, I felt I was making the skirt with the presenter, taking the steps with her.)

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
◯	◯	◯	◯	◯

3. Did the soundscape improve the experience? Was it helpful?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
◯	◯	◯	◯	◯

4. Did you find this unique or innovative way to learn?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
◯	◯	◯	◯	◯

5. Did you find this VR experience caused you to be disoriented, nauseous, or dizzy?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
◯	◯	◯	◯	◯

6. Did the written instructions help or not?

For example, did reading the written instructions before you watched the video help you understand the task?

Very Helpful	Helpful	Neutral	Little help	Not helpful
◯	◯	◯	◯	◯

7. What type of learning experiences are you used to?

- ◯ Western Instruction/Written Instruction
- ◯ Indigenous/practical/visual watching instruction
- ◯ No preference
- ◯ Both

8. Which do you prefer to learn?

- ◯ Western Instruction/Written Instruction
- ◯ Indigenous/practical/visual watching instruction
- ◯ No Preference
- ◯ Both

9. Where could you see this approach of VR instruction be used?

For example,

Science: How your blood works? How food is digested? Seeing stars in constellations.

Learning a new Language: Conversational Cree, Learning French.

Sharing Cultural knowledge: Drum making, Beading, Dance outfit making, Learning how to Dance Traditional.

Learning a skill: Cooking a chicken noodle soup. Learning how to make an electrical outlet.

APPENDIX C: Consent Form

This was given in the Survey, before they completed it in Survey Monkey.

1. Do you consent to this survey? Yes ◯ No ◯

APPENDIX D: Written Instructions

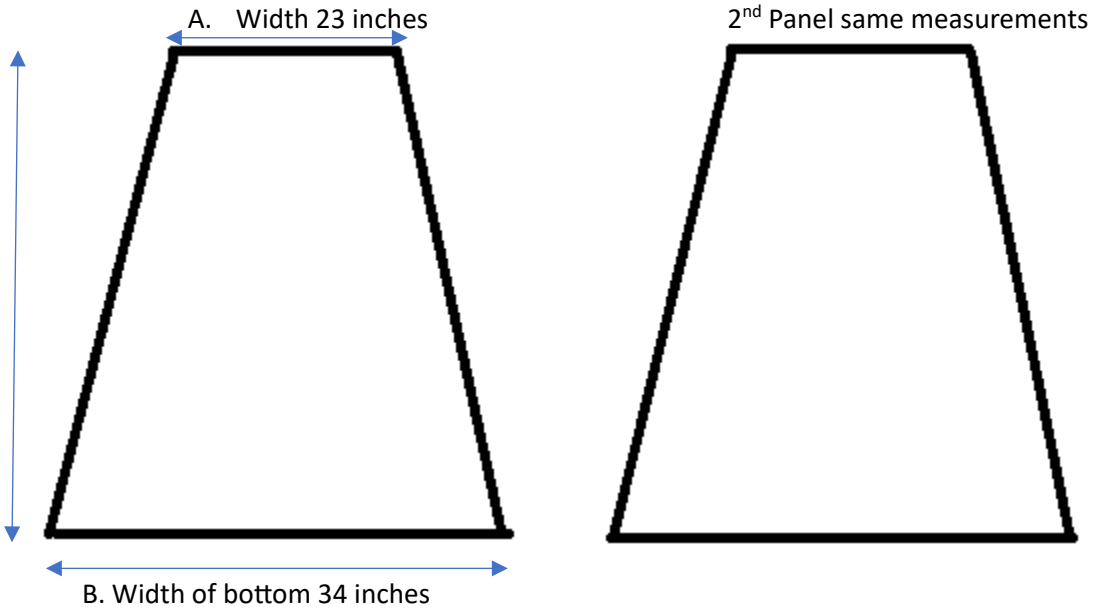
One is taking measurements (Nikki, 2022).

1) You need to measure circumference of the waistline where the elastic will sit, take your waist in inches, and divide that by 2. 2) Now add what you got in 1). For example, 45 inches is the waist measurement/divided by 2 is equal to 23 becomes measurement A. Added waist measurement to the number you got in 1, which is 45 + 23 is equal to 68. This will be the total width of fabric needed for the bottom of the skirt. Divided by 2 to make two panels is 68/2 which is equal to 34 inches, becomes measurement B.

To measure the length of the leg it is the distance from the waist to the hem. Add 2 inches on top of the skirt above the planned waist for the elastic band. Add 2 inches for the bottom of the skirt for the hem.

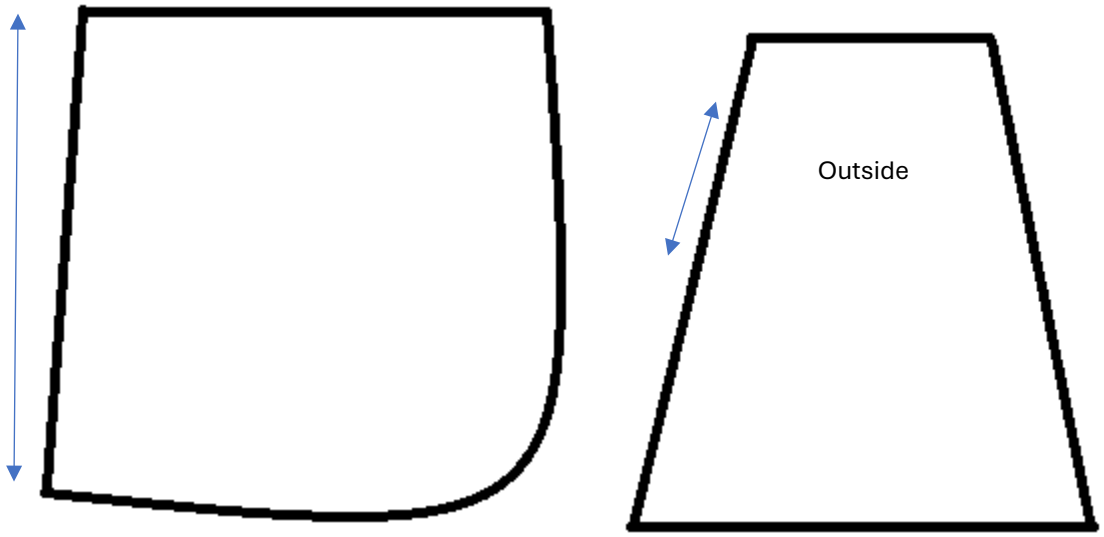
When cutting two panels you want the length (waist to ankle + 3) to be 36 + 3 which is equal to 39", becomes measurement C.

C. Length (Waist to ankle + 3) = 36 + 3 = 39 inches



Washing the fabric ahead of time especially if it is cotton, machine was in warm water and dry in the dryer. You can iron press the fabric after to get out the wrinkles.

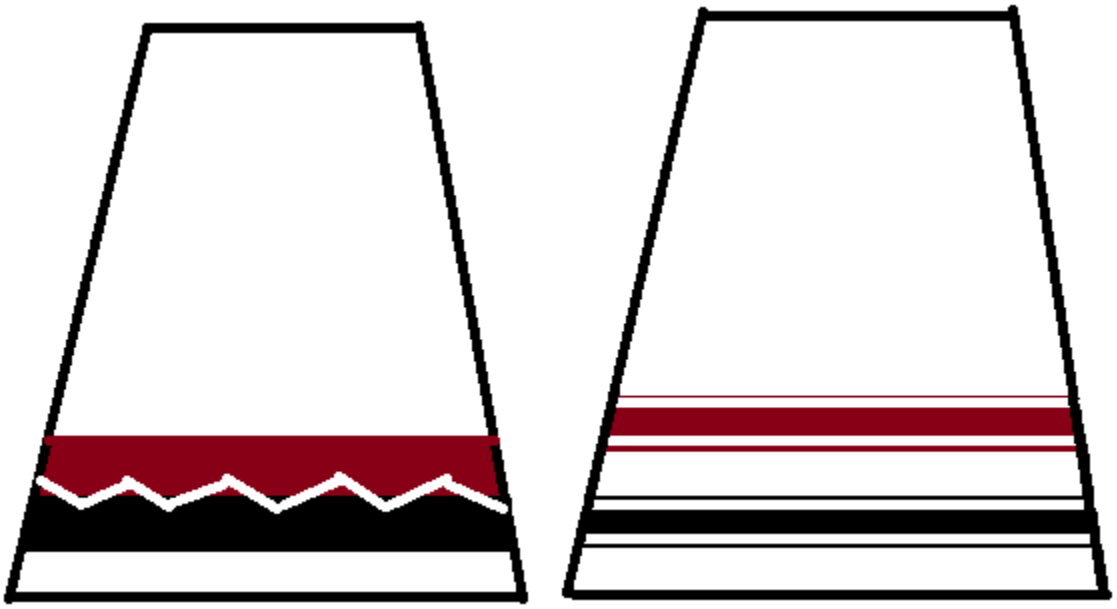
2. Cut out 4 pockets, measure a folded fabric into 4 panels and using your hand make sure it is big enough to cut out a rounded shape your hand fits in. Use this as a template



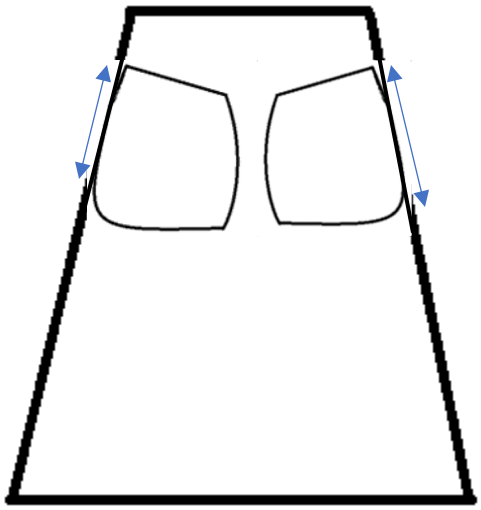
This left-hand side is going to be the side you sew on the outside of the skirt, leave 3 inches on top for the elastic band. Sew the pocket onto the outside of the skirt it will be ¼ inch on the edge of the fabric.

3. Sew the ribbons onto the skirt. You can also hem the bottom ¼ inch. You can choose to have the ribbons sewed together with a zigzag stitch or one-inch apart with just a straight stitch. You can choose up to how many ribbons fit on the skirt or just sew ribbons on the bottom of skirt. There are many designs to choose from.

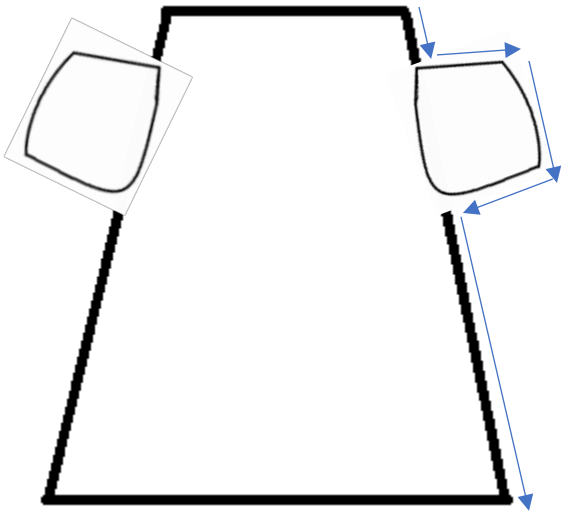
Example: a) Sew with zig-zag stitch b) Or sew straight stitch with ribbon one-inch apart.



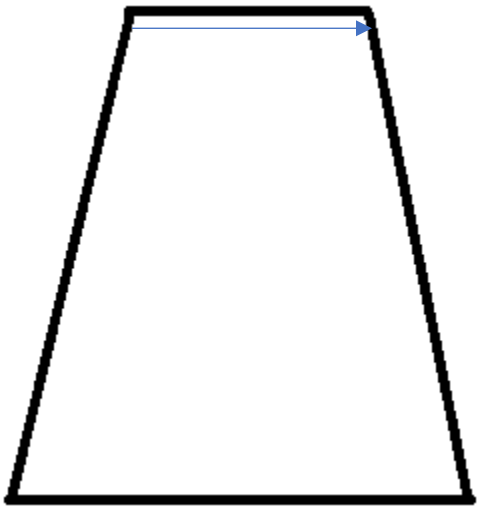
4. Once the ribbons and pockets are sewed on you are ready to join the two panels, remember to have two pockets on each side of the outside of the skirt. When sewing the two pockets will be only be on the side of the skirt



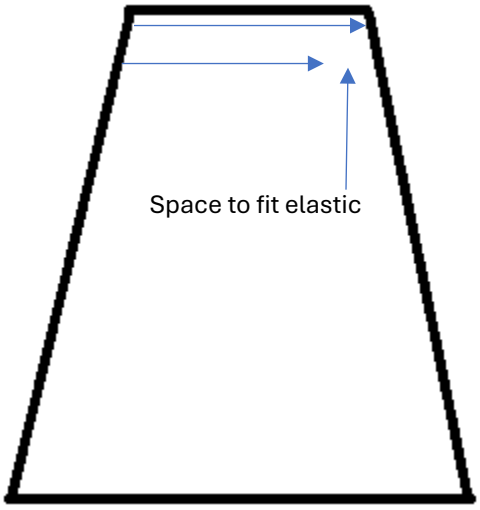
5. Sew the two panels together with the pockets facing out. Sew all along the outside, around the pockets, till you had joined the two panels together.

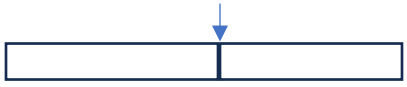


6. The elastic band for the waist can be a ¼ inch hem.



Another 1-inch space, enough for the elastic band to fit through. You can sew on the inside of the skirt by pulling skirt inside out. When sewing the space leave some room at the end to feed the elastic through. When the elastic is inserted all the way around you can sew the elastic band across the width to join the band and then sew up the space that was needed to close in the elastic band.





Elastic band sew width together