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VIRTUAL REALITY TECHNOLOGY FOR DEVELOPING INTERCULTURAL LEADERSHIP COMPETENCE: A RESEARCH PROPOSAL

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Abstract

Increased globalization requires employees to develop not just technical competencies in their specific disciplines but also intercultural leadership competence, which includes a range of cognitive, affective, and behavioural skills leading to effective and appropriate communication with culturally different others. To date, Virtual Reality (VR) and Augmented Reality (AR) have demonstrated potential in their effectiveness for achieving technical learning outcomes by providing an immersive, safe learning environment that is both engaging and personalized. Yet, while learning environments such as VR and AR have created significant interest with much promise to revolutionize learning environments, the adoption of these technologies in non-technical areas is limited. Most approaches to teaching non-technical skills such as intercultural knowledge and competence do not leverage these recent educational advancements but still depend heavily on older technologies based on one-way passive learning environments, including videos and web-based platforms. Therefore, interdisciplinary comparative research in leadership development is needed to examine the effectiveness of existing and emerging learning environments (e.g., AR, VR) on cognitive (knowledge), affective (attitudes) and behavioral (skills) aspects of intercultural competence. In addition, we have identified important methodological gaps in the realm of research in leadership development field that require the field to move beyond self-report approaches by utilizing biometric data. We propose a research project to assess leadership development in an innovative research design that triangulates data from traditional quantitative pre-posttesting with qualitative analysis of learner reflections as well as with data from non-invasive biometric devices.

Keywords: Virtual reality, intercultural competence, leadership development

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1. Introduction

Increased globalization requires that employees effectively navigate across cultures and borders to be competitive in international and global environments (Deloitte, 2017; Sorrell, 2016). In recent decades, the low cost of international communication and our ability to automate processes across the globe have pushed the business world to become truly global. As a result, employers increasingly seek workers who can not only accomplish the technical and procedural tasks assigned to them but also appropriately and effectively communicate with individuals across cultural boundaries so that they can coordinate, collaborate, and communicate with employees and clients both locally and across the globe (Banks et al., 2015). Increased globalization in business and trade has led to changes in the skills needed for success in terms of communication and leadership in diverse contexts – what we refer to throughout this proposal as intercultural leadership competence (ILC). The foundations of ILC is intercultural competence, which is the ability to communicate effectively and appropriately in intercultural situations based on one's intercultural knowledge, skills, and attitudes (Deardorff, 2004). Developing intercultural competence results in an improved understanding of other worldviews and the ability to manage thoughts, emotions, change, and ambiguity in order to effectively build bridges across cultural diversity in organizational settings (Zotzmann, 2015). Although vital in our society today, employees often fail to develop such skills. For example, only 18% of employers believe that graduates are well prepared to work with people from different backgrounds (Hart Research Associates, 2015).

Traditionally, employees have received training and education in intercultural leadership through academic study abroad, co-curricular programs, and coursework in the college or international assignments and travel in the workplace. However, each method has key weaknesses. For example, study abroad programs—arrangements in which students complete part of their degree program through educational activities outside the United States—require significant financial and logistical investments. Additionally, co-curricular programs, activities, and learning experiences that complement what students are learning in school do not present a systematic, targeted learning approach as they are based on voluntary participation. Coursework, which usually includes a number of major, minor, or elective courses that provide content around intercultural areas, typically focuses on cognitive learning, not necessarily behavioral or attitudinal development. Moreover, as with co-curricular opportunities, students can often self-select out of coursework, and those who most need intercultural learning are less likely to willingly engage in such experiences. Workplace training activities typically do not focus on an ILC approach as they either focus on leadership development in general or diversity in particular. Essentially, a key challenge of developing ILC is finding a balance between substantial economic and logistical constraints and demonstrable outcomes of effective student learning based on evidence-based best practices such as experiential and reflective learning, safe learning environment, and individualized feedback on student performance.

A potential solution that may strike this balance is the use of technology-assisted instructional approaches such as video, virtual reality (VR), and augmented reality (AR). Historically, common techniques utilized in intercultural learning have included "group discussion, lectures, case scenarios, clinical experiences, cultural immersion, and presentation by ethnic minority speaker" (Long, 2012, p. 104). While video-based learning has been widely used in higher education and workplace training, it has often

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been criticized for its passive learning environment with little or no emphasis for learner interactivity (Borgo et al., 2012; Tuong et al., 2014). More recently, with the advent of immersive online learning environments such as augmented reality games, virtual military environments, and immersive second language learning environments, these newer learning aids have demonstrated capacity for technical and social skill development (Monahan et al., 2008; Pana et al., 2006; Rutledge et al., 2008). Based on these advancements, these emerging learning technologies present strong potential to serve as effective learning approaches for promoting all three domains of intercultural competence development including knowledge (cognition), attitudes (affect) and skills (behaviors). Given their demonstrated effectiveness with more technical skills, VR and AR should prove helpful in student mastery of specific key competencies including many that have been linked as important to intercultural competence (Deardorff, 2006): empathy, openness and curiosity. However, comparative evidence of the effectiveness of these different approaches to intercultural competency development learning based on robust research is lacking. Further, there is a gap in the literature on how, and to what extent, ILC development occurs in the new learning technologies of VR and AR relative to the more traditional approach of videos. We seek to understand how the development of intercultural competency transfers from one learning domain to another. In light of this gap we are concerned with the limited research designs that have been used to document intercultural learning in general and competency development in particular. Missing from the literature is a holistic learning approach that moves beyond the cognitive domain to consider affective and psychomotor learning as well (Enger & Lajimodiere, 2011). Likewise, most studies of intercultural curricular effectiveness do not take advantage of technological solutions to measure phenomena; rather, existing work relies heavily on more anecdotal evidence such as time on task and self-report scales as proxies for engagement in learning rather than biological indicators of engagement (Villani et al., 2012). The goal of this proposal research is to compare the effectiveness of these three technology-assisted media (video-based, virtual reality, and augmented reality) for developing intercultural competence. By utilizing data triangulation through robust research methods in quantitative, qualitative, and biometrics, we aim to further advance pedagogical practices while also potentially providing new insights into theoretical underpinnings for the science of learning.

1.1. The Project

In response to the problems outlined above, we propose to study the impact of three technology-assisted interventions on STEM students' learning and compare the effectiveness of these approaches – that is, video-based, VR-based, and AR-based simulations – for ILC development. In this uncharted context, we propose to assess individual learning with the triangulation of data from multiple methods (e.g., validated quantitative inventories of intercultural sensitivity, empathy, openness, curiosity, motivation, and holistic measures of learning across multiple domains) as well as with data from non-invasive devices that monitor involuntary biological indicators of emotional arousal (e.g., galvanic skin response/electrodermal activity to measure physiological responses in the electrical resistance of the skin caused by emotional stress, eye tracking to measure visual attentiveness, electromyography to measure muscular electrical activity from the surface of the skin, electrocardiography to measure emotional arousal by recording heart rate as well as heart rate variability, and facial emotion recognition to measure head position and facial

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micro-expressions). In order to accomplish the proposal goals, we target the following objectives and employ the listed research approaches:

Objective #1: To compare the effectiveness of three technology-assisted learning approaches (video, VR, and AR) for intercultural competence development, we will create and implement three learning simulations and analyze the learning outcomes of each approach with a mixed methods design.

Objective #2: To explore potentially-new theoretical insights related to learning science, we will assess the extent to which each of the three learning environments under investigation encourages learner engagement.

Objective #3: To build on research methods in learning science, we will integrate biometric data collection with self-report instruments and qualitative analysis of student reflections in our comparison of media.

Addressing the need we have identified for effective, engaging, safe, and scalable learning approaches to developing intercultural competence, the outcomes of this research proposal will include (a) potentially significant findings in advancing learning science through documentation of complex interactions that occur between learner attributes and learning environments, (b) a vital understanding of the potential of each of the three technology-assisted learning medium for facilitating intercultural competency among STEM learners, and (c) findings from innovative uses of biometrics in the assessment of learning collected through this effort.

2. Literature Review and Theoretical Framework

Scholarly literature from several disciplines, including learning science, technology-assisted learning technologies, and intercultural competence provides a solid theoretical basis for this project. We review in this section literature relevant to the design and assessment of learning technologies.

2.1. Learning Science

Understanding the benefits, challenges, and implications of using differing forms of instruction requires a recognition of and reliance on research related to learning science. We identified several key components, theories, and aspects of learning which directly relate to our project and the accompanying rationale.

2.1.1. Experiential Learning

Understanding how VBL, VRL, and ARL environments may impact student learning fits well within the realm of experiential learning. Experiential learning is rooted in modern learning theories, which have often pointed to constructivist conceptualizations of learning (Driscoll, 2005; Lave & Wenger, 1991). We posit that a highly relevant theory of learning for AR and VR applications, which falls within the constructivist tradition, is the Experiential Learning Theory (ELT) (Kolb, 1984; Kolb et al., 2001). ELT sees learning as "the process whereby knowledge is created through the transformation of experience" (Kolb, 1984, p. 41). The ELT model considers two related modes of grasping experience, concrete

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experience and abstract conceptualization, and two related modes of transforming experience, reflective observation and active experimentation. Each of these modes relates directly to AR/VR as learners engage in their own experience-making. Dalgarno and Lee (2010) specifically highlighted experiential learning as one of the core affordances of VR, and ELT has been a common framework used in the design of learning games and simulations (Gredler, 1996; Kiili, 2005).

2.1.2. Motivation to Learn

Another core element linked with our proposed research into different learning approaches is an appreciation for student motivation to learn. Stipek (1993) highlighted to connection between motivation to learn and actual learning; Stipek was joined by Pintrich et al. (1993) who demonstrated that the goals learners pursue, as well as the effort they expend towards reaching those goals, all play into the overall learning achieved by any individual. Further, Keller (2008) identified 5 principles for effectively motivating student learning: 1) learner curiosity is aroused by identifying knowledge gaps, 2) motivation is promoted when targeted learning is meaningful to learner's goals, 3) when learners believe that they can successfully learn, 4) when "learners anticipate and experience satisfying outcomes to a learning task" (p. 177), and, 5) when learners employ self-regulated learning strategies. An understanding of student motivation is critical as efforts are made into identifying the strengths and weaknesses of the identified approaches in this work. Closely related to learner motivation is the work around self-efficacy which connects motivation with an individual's judgment of his or her capability to perform actions to realize specific goals (Bandura, 1977). Self-efficacy has shown validity in "influencing such key indices of academic motivation as choice of activities, level of effort, persistence, and emotional reactions" (Zimmerman, 2000, p. 86). Understanding key components of the learning approaches identified as well as both the motivation, and in turn the self-efficacy, of learners is critical in this work around identifying best-practices in learning.

2.1.3. Learning Engagement

We draw connections between our proposed work and engagement - learning technologies can not only motivate learners but also engage them, providing them an experience that captures their attention (Bannon, 2005; Quinn, 2005). O'Brien and Toms (2008) synthesized aesthetic, play, and flow theories to define a model of engagement. They described engagement as being comprised of ten attributes: aesthetic, affect, focused attention, challenge, control, feedback, interest, motivation, novelty, and perceived time (O'Brien & Toms, 2008). Attempts to measure engagement have typically focused on self-reported measures, performance indicators as correlates of engagement, and biometric measures (O'Brien & Toms, 2010). Our work is rooted in this understanding of learner engagement and the impact of this engagement on their own learning.

2.2. Technology-Assisted Learning Environments

With the advent of technology, learning environments are becoming increasingly technology centric. Although rapid technological advances are often adopted, the implementation and utilization of these new approaches to learning can be slow due to logistical and resource limitations. In addition, the nature of an

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educational environment, may equate with advances in research also lagging behind the technological innovations. We theorize that the greater immersive nature of VRL and the greater interactive qualities of ARL will enhance learner engagement and thus foster greater achievement of learning outcomes, but more exploratory research is necessary to understand better the relationships between these phenomena and to predict accurately which medium best enhances intercultural competency learning.

Video-based Learning (VBL). The popularity of video-based learning through platforms such as Khan Academy, Lynda, YouTube, and edX has resulted in millions of learning experiences in recent years (Brooks et al., 2011). As widespread adoption of technology has multiplied so has research into video-based learning, learner engagement with video-based learning platforms, and integration of video-based learning into existing structures and courses (Giannakos, 2013). Yousef et al. (2014) conducted a meta-analysis of research related to video-based learning from 2003-2013 and, despite conflicting results, concluded several pertinent points: VBL has the potential to improve learning outcomes, results in higher levels of satisfaction compared to settings without video, and is most-often connected with a more passive teacher-centered approach as opposed to utilizing student-centered learning. Building off previous work into VBL, recent work in the VBL sphere has sought to further improve upon benefits recognized in static VBL settings through interactive VBL applications. For example, Kolas (2015) identified videos which include hyperlinks, interactive 3D-objects, interactive maps, and embedded quizzes as VBL applications which are interactive for students. The use of interactive VBL has demonstrated potential for increasing student engagement (Zhang et al., 2006) but has also been less favorably looked upon by many educators who deem it passive and not engaging (Kolas, 2015).

2.2.1. Virtual Reality-based Learning (VRL)

Virtual Reality (VR) technologies that utilize electronic eyewear to immerse an individual in a computer-simulated environment is considered an emerging tool for providing immersive, engaging and autonomous learning environments for both academic and professional purposes. Recent technological advances have increased the resolution and dramatically reduced the cost of deploying VR material. In fact, the findings of a recent survey on the use of digital technologies to drive digital business transformation indicated that of the 29% of organizations which are using or piloting immersive learning technologies, 40% reported that the tool exceeded their expectations, while 60% reported that the technology performed as expected (Cearley et al., 2017). Two decades ago, VR had to be played on a desktop computer or on custom-built proprietary headsets, however, commercially available VR headsets today are the most commonly used approach to deliver VR material, because they provide the greatest sense of immersion as they replace the real world with the virtual one through complete visual occlusion (see Figure 1). These advances mean that VR has rapidly become an inexpensive and viable learning tool in fields such as engineering, medicine, chemistry, and other hard sciences (Clark et al., 2016; Freitas, Rebolledo-Mendez et al., 2006). Similarly, previous studies on VR interventions for intercultural skills have either focused on better second language acquisition (Thorne et al., 2009) or have examined military recruits and personnel, who presumably would have had much more rigor prior intercultural training (Caligiuri et al., 2011). Relatedly, while it has been proposed that VR holds great promise for developing empathy, empirical evidence supporting the claim is virtually non-existent outside of healthcare settings (e.g., Wijma et al.,

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2018). Although VRL offers the prospect of exponentially increasing the scale of implementation and present the advantages of a safe learning environment for engaging in potentially uncomfortable social interactions, VR as an immersive learning tool needs to be tested for its potential, capacity, and extent in contributing to the achievement of specific learning outcomes related to the development of intercultural competence (Diehl & Prins, 2008; Hickman & Akdere, 2017).

Figure 1. Samples from VRL simulations

2.2.2. Augmented Reality-based Learning (ARL)

ARL draws its origins from the mid-twentieth-century in cinematography (Carmigniani et al., 2011), and, with the development of computer technologies more generally, has seen steady rises in usage and implementation (van Krevelen & Poelman, 2010). In 2007, AR was identified as one of the top 10 emerging technologies (Jonietz, 2007), and, according to some researchers, is set to become one of the fundamental user interface paradigms of humankind (Kroeker, 2010). AR is usually defined following the VirtualityContinuum (Milgram & Kishino, 1994), where it resides closer to real-life than pure virtual reality (VR) and, as such, combines aspects, and objects, of both the virtual and real world (see Figure 2) (Azuma et al., 2001). AR can be understood as a real-world view that is augmented and enhanced by virtual, computer generated, information (Caligiuri et al., 2011; Klopfer & Squire, 2008), allowing users to have a realtime interaction with virtual creations in 3D space (van Krevelen & Poelman, 2010; Wu et al., 2013). In other words, AR does not replace the real world as VR is purported to do, but, in a way, supplements it through building a "mixed-reality" model (Bower et al., 2014; Chang et al., 2010). In terms of devices and user-interaction, AR is mainly facilitated through two main display types: monitor-based and see-through; presently, these largely include Head Mounted Displays and Handheld Display devices (Kesim & Ozarslan, 2012; Klopfer & Squire, 2008). AR uses different technology that can range from basic hardware, such as video camera, for capturing live images, storage space for virtual objects, a processor powerful enough to build a 3D simulation in real-time, and an interface for interactions with objects—both virtual and real—as well as more complex hardware that includes GPS, WiFi connection, image recognition, and more (Bower et al., 2014).

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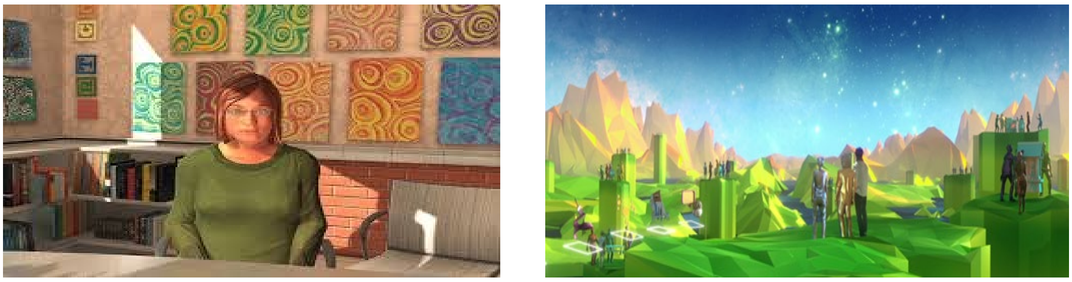

Figure 2. Samples from ARL simulations

Given that this technology allows users to engage with and experience phenomena otherwise not possible (Klopfer & Squire, 2008), AR has had many applications over the last decades, from such fields as manufacturing (Caudell & Mizell, 1992) and medicine (Bajura et al., 1992), to sports and military (Azuma et al., 2001). In recent years, special interest has developed around leveraging AR in educational contexts (Kesim & Ozarslan, 2012; Radu, 2014) because it can benefit learners along a number of dimensions, including learning spatial structure and function, memory retention, language learning, improved collaboration, increased motivation and physical task performance (Radu, 2014). Dede (2009), for example, points out that the immersive side of AR can be leveraged to enhance learning through *multiple perspectives*, and through *situated experience*, both important opportunities in the learning process. More specifically, AR has been explored as a tool in technology education, since the ability to create 3D images is especially important in design technology and engineering (Thornton et al., 2012). Further, AR positively affects the motivation of students in STEM education (Restivo et al., 2014; Yoon et al., 2012), especially mathematics (Estapa & Nadolny, 2015). While most of these studies analyze the students' perspectives, there have also been applications of AR technology that aid in instructors' formative assessment of students (Holstein et al., 2018; Holstein et al., 2017), that facilitate interaction between students and teachers (Peña-Ríos et al., 2012), and that teach industrial maintenance and assembly tasks in workplace training (Gavish et al., 2015).

2.3. Intercultural Competence

Intercultural competence is the ability to communicate effectively and appropriately in intercultural situations based on one's intercultural knowledge, skills, and attitudes (Deardorff, 2004). Developing intercultural competency leads to improved understandings of other worldviews and the ability to manage thoughts, emotions, change, and ambiguity in order to effectively build bridges across cultural diversity. Thus, intercultural competence is considered vital for individual success when working with culturally diverse coworkers, suppliers, and clients (Lévy-Leboyer, 2007). Many contemporary scholars view intercultural competence within a developmental framework – that is, as a set of related competencies which it is possible to improve over time and as a result of experience, and not merely a collection of static personality traits (Hammer, 2015). In other words, intercultural competence is imminently learnable. Myriad definitions of intercultural competence exist in scholarly literature, with some emphasizing the role of language and localized cultural knowledge and others focusing on globally transferable components such as positive attitudes towards cultural difference and cultural discovery skills (Acheson & Schneider-Bean,

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2019). Most scholars, however, agree that intercultural competence is comprised by some combination of attitudes/affect, knowledge/cognition, and skills/behavior (Spitzberg & Changnon, 2009).

Despite the complexity and variation that has characterized scholarly treatment of intercultural competence operationalization, there exists a long history of intercultural competence assessment. The construct is measurable both holistically and by focusing on its specific components (Fantini, 2009). Assessment of intercultural competence does not always take the form of self-report quantitative measures. The American Association of Colleges and Universities led the creation of a series of rubrics for qualitative assessment in higher education known as the Valid Assessment of Learning in Undergraduate Education (VALUE) rubrics (AAC&U, 2010). Among these rubrics is one for Intercultural Knowledge and Competency, which delineates six components of the construct for assessment: the knowledge components of cultural self-awareness and cultural worldview frameworks, the skills of empathy and verbal/non-verbal communication skills, and the attitudes of curiosity and openness. We drew our learning outcomes of openness, curiosity and empathy for the current project from this rubric and paired them with validated measures (described in more detail in the sections below). The most important theoretical framework for our current project, though, is Deardorff's (2006) Pyramid model of intercultural competence, because this model allows us to organize the components of intercultural competence into a hierarchy and understand their order of acquisition. The theoretical model provides justification for our choices of learning outcomes as foundational prerequisites for higher order skills and as culture-general components that are transferable from one cultural context to others.

2.3.1. Openness

Intercultural openness is widely recognized as an important component of intercultural competency. For example, in the AAC&U's (2010) VALUE rubric for Intercultural Knowledge and Competence, the attitude of openness involves both willingness to interact with culturally different others and the capacity to suspend judgment and consider alternate interpretations during those interactions. Many other models of intercultural competency, including Deardorff's (2006) Pyramid model, highlights the importance of openness. In fact, Deardorff's model places openness at the base of the pyramid, implying that development of intercultural competency cannot continue without this foundational attitude. As such a well-recognized and foundational aspect of intercultural competence, openness is therefore a suitable focus for the interventions in this study. One demonstrably valid instrument (16 self-report Likert-scale items) used to measure openness is the Attitudinal and Behavioral Openness Scale (Caligiuri et al., 2011).

2.3.2. Curiosity

The attitude of curiosity, characterized by the willingness to and habit of asking complex questions about aspects of culture that lie below the surface (not easily accessible to cultural outsiders), is considered an important component of intercultural competence (AAC&U, 2010). Along with openness, curiosity forms the attitudinal foundation for the development of intercultural competence (Deardorff, 2006). Specifically, curiosity enables the development both cultural self-awareness and awareness of others' the cultural norms, values, and beliefs that undergird the more visible aspects of culture, including cultural artifacts and patterns of behavior. One instrument that has been validated for use in studies exploring the

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role of curiosity in motivation and learning (Kashdan et al., 2009) is the Curiosity and Exploration Inventory (10 self-report Likert-scale items).

2.3.3. Empathy

Empathy is a complex skill that involves understanding the experiences, perspectives, and emotions of others (AAC&U, 2010). Intercultural empathy is especially challenging because cultural differences function as barriers to understanding others. Deardorff (2006) places it toward the top of the pyramid model because the performance of this skill often requires positive attitudes such as openness as well as a certain threshold of cultural knowledge. An instrument that was developed to measure empathic responses across ethnic and racial differences is the Scale of Ethnocultural Empathy (30 self-report Likert-scale items). This instrument encompasses 4 factors: empathic feeling and expression, empathic perspective-taking, acceptance of cultural differences, and empathic awareness (Wang et al., 2003).

2.4. A Biometric Profile of Social Competence

Biometrics is defined as the use of distinctive, measurable physical characteristics to describe individuals, which can generally be divided into two groups: those that serve as identifiers of the body (such as fingerprints and retina scanning), and those that pertain to psychophysiological measures of human behavior and psychological state such as eye tracking, facial expression analysis, galvanic skin responses and electroencephalography (Jain & Ross, 2008). In the latter case, biometric tools attempt to classify an individual's visual attentive process and emotional expression in terms of emotional arousal (intensity) as well as emotional valence (positive versus negative hedonic affect); (Barrett, 2006; Kron et al., 2015; Russell, 1980). Often, a biometric tool (see Figure 3) will provide information on one dimension more than another; galvanic skin responses (GSR) and electrocardiography (ECG), for example, are often used as measures of arousal but not valence (Berntson et al., 1997; Boucsein, 1999; De Santos et al., 2011; Torres et al., 2013), while facial Electromyography (EMG) and Facial Emotion Recognition (FER) can provide valenced information but are less likely to provide an accurate measure of intensity, although intensity can contribute to the correct identification of an expression (Balconi et al., 2014). Thus, the use of multiple sensors in a multimodal approach is necessary to provide the most comprehensive profile of an individual's psychophysiological reaction to stimuli (Balconi et al., 2014; De Santos et al., 2011). Within the context of social interaction, a limitation of conventional self-report methods is that one's feelings, attitudes and reactions may not be articulated to their fullest extent. This may be due to social desirability bias, language barriers, cultural norms, or inaccurate recall of emotional events. Here, biometrics is best used in conjunction with conventional self-report methods, as physiological responses to stimuli are involuntary and beyond conscious control. Thus, biometrics can provide valuable information as to the emotional and attentive state of the respondent in real-time, without the limitations of language or bias.

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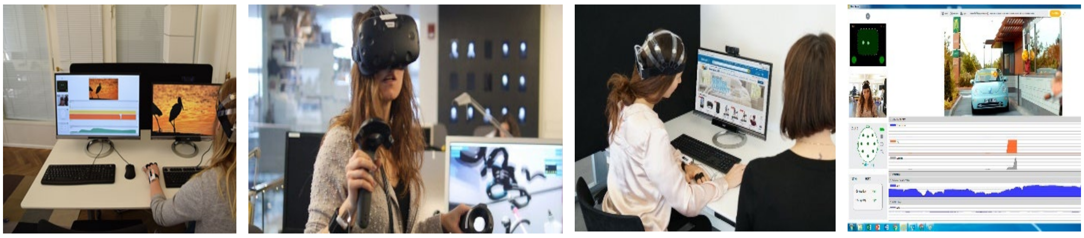

Figure 3. Biometric software platform in use.

3. Research Method

The proposed study will be designed as a quasi-experiment to test the effectiveness of technology-assisted learning environments in intercultural development through VBL, VRL, and ARL, each with similar intervention content. Therefore, there will be three treatment groups, each comprised of at least 50 participants. Our independent variables will include demographic variables (gender, race/ethnicity, and language) and personal attributes (motivation to learn, pre-existing levels of intercultural competence—openness, curiosity, and empathy--obtained through pretesting with self-report instruments). Qualitative and biometric data will also be collected and analyzed in triangulation with the quantitative data to present as complete and nuanced a picture of the complex learning processes.

All three sets of simulations in this study will feature similar content, varying primarily in medium of instruction (VBL, VRL, and ARL). The simulation series will immerse learners in an international business case where they develop intercultural knowledge and competence. Within the simulations, learners are responsible for securing a business deal with a Latin American distribution company. In these technology-assisted learning simulations, the participants will complete the simulations on their own, in a safe and replicable learning environment. Importantly, all three technology approaches to teaching and learning being studied in this project differ from each other in the level of interactivity and authenticity provided by the medium, particularly for the VRL and ARL. This is accomplished by immersing learners, giving them first-hand experience of being in an international business setting and providing them with opportunities to interact with their environment in the form of speech and behavior choices to which characters within the simulations react and respond. Additionally, learner choices during the simulation change the future outcomes (i.e., a range of successes or total failure to secure the business deal). In response to stimuli within the simulation, learners choose from a set of behavioral responses that will be designed in consultation with intercultural education, business, and learning science experts to ensure that the choices represent the likely responses from individuals at varying levels of intercultural competence and business acumen.

4. Conclusion and Discussions

By exploring innovative learning environments for more effective teaching of ILC to STEM students, this research proposal has multiple and far-reaching impacts on industry, scholarship, and society at large. Improved skills and attitudes such as openness and empathy have great potential to positively impact the capacity of intercultural teams in the workplace to leverage their differences for creative

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problem-solving and innovation, rather than being stymied by an inability to interact successfully with culturally different individuals and groups.

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