IMPORTANCE OF EMOTION DESIGN IN MULTIMEDIA EMERGING TECHNOLOGIES FOR CHILDREN AND TEEN EMOTIONAL MANAGEMENT

by

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Abstract

While multimedia usage in learning has seen a significant increase in many teaching disciplines, the use of emerging technologies to present a personalized experience has proven to be particularly more effective with younger demographics because of their level of familiarity with technological media. (Fleck et al., 2014)

*By facilitating self-expression, experiential learning, and the immersive praxis of SEL (*Socio Emotional Learning) *Theory, this research aims to demonstrate the potential benefits of incorporating emotion design with multimedia technologies. Together, these techniques can enhance the impact of learning methodologies and the depth of psychological effect on young teens in their developmental education.*

This paper discusses the creation of a novel Virtual Reality experience for the Oculus platform that uses a musical and artistic expression to place the user's emotions into perspective.

Keywords: *emotion design, emotional regulation, teens, virtual reality, virtual experience, artistic expression.*

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Introduction

These competencies gain particular importance in countries like Colombia, where a history of continued armed conflict has left many generations of people in a vulnerable social condition. Young students growing in situations of poverty and violence lack the conditions to achieve success and develop safe and healthy coexistence values and practices (Posso Chaparro et al., 2017). These conditions not only compromise individuals, but help perpetuate cycles of aggression and social instability (Osorio Mejía & Aguado Quintero, 2018). In order to counter these cycles, Colombian conflict -social enterprises like Coschool-co are employing SEL principles to build project-based learning programs to teach the skills in public schools. These programs seek to empower youths in vulnerable societal sectors and to equip them with the emotional toolkit necessary to turn their lives around.

Coschool's educators struggle daily to motivate youths who are traversing difficulties stemming from their unfavorable environments, which negatively impact their ability to excel in schooling, and hinder their ability to establish healthy relationships. Developing strategies that rely on current media, modern technology, and innovative audiovisuals may be key to win over the interest of young learners. This approach, generating impactful life changing experiences closely in line with their current interests (movies, media, games, music etc.), can be a valuable one. Modern methodologies call for a creative approach, blending pedagogical content with meaningful emotional experiences tailored to have an impact on this particular demographic of users.

The appearance of Virtual Reality (VR) has sparked particular interest due to the innovative sense of immersion which enhances the sense of presence (Servotte et al., 2020). This platform has proven to be particularly effective in learning and rehabilitation purposes by maintaining higher levels of engagement. It also can reinforce knowledge acquisition via repetition and feedback reception(Caldas et al., 2020). As Mayer (Mayer & Estrella, 2014) notes, "*redesigning multimedia lessons to incorporate emotional design principles significantly improves learning outcomes".*

Combining new technologies with Coschool's current needs to promote emotional management utilizing SEL principles in Schools located in the City of Santiago de Cali, Colombia, offers a unique opportunity to solve a problem via innovation aimed at supporting initiatives with the intent of modernizing education in developing countries.

This Masters Research paper explores the importance of harnessing emotional design techniques in a virtual experience to promote emotional development, self-awareness, and self-management in young teens. We create a game prototype in a VR environment, allowing players to interact with musical rhythms while fostering the practice of SES (Social Emotional Skills).

Literature Review

This paper will focus on the importance of incorporating the Principles of Emotional Design (ED) into a meaningful digital experience that can elicit the positive emotional response in the users. ED breaks down the design process into three main categories which correspond to three levels of design: Visceral, Behavioral and Reflective. These categories correlate with how users approach a design experience throughout their emotions. Visceral Design pertains to our most primitive and primal reactions when placed in context to certain objects. For example, when hungry our stomach will growl and we will seek appropriate nourishment we enjoy, regardless of who we are or the food we enjoy the feeling of hunger and the bodily reaction is present in us all. The visceral level of design does not require much forethought, as users are meant to react instinctively to common evolutionary inheritances that appear in everyone regardless of sociocultural context (Donald A. Norman, 2004) (Kamil & Abidin, 2013).

Behavioral design, however, does require some level of cognition related to the familiarity *(experienced gained by repeatedly performing a task)* and control *(understanding and knowledge of the interface or inner workings of the mechanism used)* of the design experience and any of its objects. In other words, we adapt our human behavior to patterns and carry out basic actions while thinking about other things *(auto pilot actions).* For example, regardless of location or language the majority of people understand how cars are driven. Not everyone might know how to drive, but they may at least have a grasp of what the wheel does by turning and how brake and gas

pedals work. When entering a vehicle, even if you're not the driver, you have a clear understanding that the machine will move, you will be transported and will remain seated with a seatbelt and a closed door (Donald A. Norman, 2004) (Germonprez et al., 2011).

Reflective design demands a high level of cognition, as its very name states. In order to understand this design level users must look back upon specific experiences and reference their own expectations and feelings against the design itself. Depending on their particular socio-cultural context and past experiences, a person might develop reliance upon prior knowledge or conjectures about certain subjects, influencing their feelings and the final emotional impact of their interaction. There are strong cultural implications that stem from using a certain product; for example, what do people think of a person that uses Gucci vs store brand? Will my ego or myself perception improve if I ride a particular luxury car? If how others perceive me depending on my design choices, does a particular design option elicit a desired reaction beyond the effectiveness of an item's function? All these questions represent the weight of reflective design upon users, and the importance of emotions generated by the complexities risen by thoughtful design choices (Sengers et al., 2005).

Interconnecting and correlating visceral, behavioral, and reflective design aspects effectively results in an appropriate appeal of user's emotions. Compounding coherent design functions with emotional design produces an impactful experience that answers to user's emotional values and needs. As Don Norman notes in both The Design of Everyday Things (1988) and Emotional Design (2004), : *"attractive things work better"*- because making accurate emotional appeals stimulate various levels of cognitive

pleasures, targeting the participants physiological, sociological, psychological, and ideological senses paint a fuller picture of the human experience. ED successfully integrates human values to design experiences and result in elevated interactions of memorable importance.

In multimedia experiences, music can be used to adhere sentimental value to scenes, becoming an ideal companion; undeniably music can powerfully augment emotional value that guides the purpose of the content itself. People can, regardless of sociocultural background, assign an emotional nature to a tune by ear alone.(Hunter & Schellenberg, 2010)

Infants can have strong music perception skills quite similar to the average music listener years later, when placed in conditioning procedures that alter pitch and timing children can detect minuscule differences that are musically meaningful (Trehub, 2003). Later on, in life as we grow and develop with our peers we will begin to use cultural specific cues to attribute meaning to the music we listen to, which influence particular judgement on complex emotions depending on particular experiences. Nonetheless, it is still possible to a certain extent for outsiders of a specific culture to misinterpret an intended emotion expressed in a culture that is unfamiliar. It is important to note that, given the research context of experiments that validate this claim, most emotional responses available to participants at the moment of evaluation tend to be basic (eg. happy, sad, angry) and their correct assessment relies on acoustic qualities of the music samples (Balkwill et al., 2004).

Whether by acoustic assessment of music or by using their own set of cultural cues, listeners are able to identify emotions expressed in unfamiliar music from foreign

cultures with accuracy above that of pure chance. This implies that combining varied cues like the ones noted above musical emotion is recognizable by all to a reasonable degree (Swaminathan & Schellenberg, 2015).

Said universality of melodies and rhythms grants us the ability to recognize natural patterns in sounds and the emotions attributed to them by everyone else in accordance to their context. Music can engage all three levels of processing viscerally, behavioral and reflective, simultaneously. The brain is immersed in action, perception and cognition. Some aspects of music are perceivable by everyone, while others are apparent to individuals of a particular culture. Some can be learned by communicating and others are subject to interpretation It's important to also note that music works on a conscious but also on a subconscious level. We can actively sing and dance, or we can quietly follow a tune in our head as it evokes a memory (Norman, 2004). The same experience can produce enjoyment and displeasure. This brings particular importance to our project, because through music we can induce negative emotional states of sadness or anguish (Juslin & Västfjäll, 2008). This ambivalence offers a unique perspective where users can judge emotional shifts, as well as their reactions to any of said shifts in a particular moment. Identifying the emotional state is key but also identifying that transitional state opens the gateway to managing these emotions(Mohn et al., 2011).

Acoustic characteristics like tempo, dynamics and timing significantly influence emotional recognition. Musical cues correspond similarly to speech and voice intensity patterns and allow for the successful decoding of emotional cues. There is a clear distinction between high keys and low keys and the correlation they have with

perception of happy and sad emotions, as well as an innate range of natural frequencies associated with bodily functions which sync with acoustic characteristics mentioned beforehand. Across different cultures there is substantial evidence of the development of musical scales similarly designed due to the biological capabilities of the ear and the corresponding musical octaves in the score (Laukka & Gabrielsson, 2000).

Research results show clear evidence of the efficacy of musical performance as a therapeutic aid in emotional management (Moore, 2013), and identifying one's emotions and having enough emotional intelligence to apply the right framework is vital to start an effective Socio Emotional Learning Process (Sel Practices, 2020). Emotional regulation is described as a person's ability to manage and respond to an emotional experience, and the capacity to identify an optimal course of action to deal both with positive and challenging emotions and their consequences (Rolston & Lloyd-Richardson, 2017).

According to the SEL framework, management of emotions, and the application of SES are the pillars to the development of a proficient emotional intelligence (Durlak et al., 2011). Rigorous management and understanding of the principals of SEL facilitates the healthy development of relationships, and the emotions raised by them. CASEL divides its framework into core competencies:

1. Self-awareness is defined as the ability to recognize one's emotions with accuracy, accounting for their influence on behavior as well as one’s strengths and weaknesses, without losing an objective sense of confidence of optimism.

2. Self-management refers to the capacity of regulating our emotional outputs as well as thoughts and behaviors with efficacy depending on a particular context. Managing feelings like stress, impulses, motivation while maintaining and achieving plausible goals.
3. Relationship Skills, much like its name implies, are about our ability to establish, maintain and develop healthy purpose full relationships with varied individuals as well as groups. Other important humanistic values like cooperation, communication, active listening, resistance to negative social pressure, negotiation skills, constructive criticism, and empathy also matter because they are what allows for continued lasting interactions (Casel.org, 2020).

SEL methodologies for the development of SES lay the groundwork, while Emotion Design should be applied in the development of a truly transformative experience. Working towards gaining valuable knowledge in matters of emotional development clearly requires going through a process of strong self-expression. Through self-expression people can learn to adjust levels of self-emotional regulation according to life's particular context. As children, we catch contextual clues directly from our parents and elders via practical interactions shared within the family group. However societal factors can also have certain levels of impact related to cultural context (Chen & Zhou, 2019). Therefore, it becomes necessary for students to have access to experiential learning, and to emotional literacy processes where they can gain abilities independent from their context of family upbringing. Experiential Learning Theory (ELT) redefines learning as a process of knowledge creation via transformative experiences, by perceiving the concrete (tangible qualities of the actual experience), or by thinking,

analyzing or planning through abstract conceptualization. Whether it's at the point of gaining understanding, or actively or passively participating in an experience, we are presented with a choice, and by assuming said choice we are applying our set of criteria, literacy and emotional self-dominance(Kolb et al., 2014).

Societal impact

Ideally, child upbringing should develop under certain basic conditions of education, healthy family dynamics, social interaction and healthcare. However, in recent times the incidence of mental issues has been on the rise (Stolzer, 2016). Around half of all mental health conditions start at age 14, and end up becoming the second leading cause of death among youngsters aged 15-29 (United Nations, 2020). In times of difficulty such as the ongoing COVID-19 pandemic, 20% of people between 15-49 years of age resort to negative coping mechanisms which include addictions to drugs or alcohol (Government of Canada, 2020). A possible effective solution for this developmental challenge is a strong socio emotional education at a young age, because it counters negative effects at an early age and prepares teens to deal with future unknown challenges.

Colombia's ongoing violent conflict has given rise to many problems at a social level, whether directly or indirectly children have felt the consequences. Poverty and lack of economic opportunities often lead to children having high dropout rates at an early age (Attanasio et al., 2010). In municipalities with increased conflict intensity, an average of

58.1% of children between the ages of 10-17 carry out some sort of work related activity to aid their household, this is likely due to the early death of a household head or the need to support a working parent with extra income or house labor while they are away at work (Del Risco Bravo, 2014). According to The Organization for Economic Co-operation and Development (OECD org., 2016) about 70% of Colombian teens starting at age 15 lacked basic literacy and numeracy skills in 2016, poor infrastructure, poor quality learning resources and underpaid educators cause secondary education to fail at its mission of leading children to higher levels of education and further on to meaningful job market opportunities.

Another detrimental side effect of Colombia's violent conflict is a prevalent drug dependency issue, where marihuana has been used by 8% of the population at least once in their lifetime among other hard drugs. Most teenagers consume an average of alcohol of 46% (Dirección Nacional de Estupefacientes, 2008). This social dependency on alcohol plays a significant role in endangering young children and teens, on one side they are very likely to consume some drug by age 15 (mainly alcohol), or what could prove worse they could have a parent or family member already be a heavy consumer in the household. In addition, two million children are abused per year at home with 850,000 constituting severe abuse, 87% are under 18 years of age, and 87% percent of victims identified the perpetrator as their own father or father-in-law (Longman-Mills et al., 2011).

Since the start of the covid-19 pandemic during 2020, 99 women have been murdered by their partners during quarantine isolation in the capital city of Bogota, marking a substantial increase of domestic violence and femicide. Such recent statistics

strongly support the need for programs that target gender violence and emotional management, especially due to the fact that children are currently being negatively impacted during lockdown where it's harder to receive support from school authorities or mental health professionals (Torres, 2020)

Technology becomes key in structuring efforts that adapt to certain affordances like distance, isolation, and resources limitations. Endeavors such as: Viva la Paz VR a Colombian project which consisted in a 360 degree Google cardboard production narrating the story of Mercedes Rivera victim of massacre perpetrated by forces involved in the armed conflict. She was killed during a bus ride while heading to her hometown, and the experience takes participants along the very same ride on a POV (Point of View) perspective. The experience is meant to be a pedagogical tool that places participants in the shoes of victims and family members, with the purpose of opening perspectives to debate and strengthen participation in policy making and peace activism (Ayure, 2017)

Facebook anti-Bullying VR is an initiative originally implemented in Mexico and was, pre-pandemic, to be implemented in public schools in Colombia. In this project, school children use VR to interact in multiple bullying scenarios, and are later asked to make decisions based on the outcomes of each situation. A key aspect of this dynamic is to build on the already existing empathy among students and build pedagogy with tools that can actually lead to conflict resolution, as well as prepare students for the possible outcomes that result from everyday bullying cases (Peña Castañeda, 2019).

Research on the impact of VR platforms and interactive experiences on human emotion as well as the examples shown above strongly support the creation of digital

experiences to support socio emotional pedagogy. Based on the demographic information gathered and the positive results from similar endeavors within Colombia's current context, we have chosen to create a Virtual Reality Gaming experience based on rhythm gameplay mechanics to be used as support material in Coschool's foundation learning processes.

Inspired by Don Norman's emotional design principles and music's powerful cultural and emotional influences, we will use Virtual Reality goggles to tailor an experience for young children studying in public schools in the city of Cali. The pedagogical framework will be based on CASEL emotional awareness and emotional regulation strategies and a creative music mechanic that will blend elements of nature with mood changes to generate introspection on students.

Methodology

With the aim of creating a prototype that accomplishes the goal of strengthening the Coschool's organization workshops in regards to the use of emerging technologies, this project was developed under the principles of design thinking, using iterative design and consultation with communities. Due to the rise of the COVID-19 pandemic it has not been possible to carry out a testing stage for the project. However, the prototype stands as a fully functional experience that could be tested in the future by an interested third party with the proper involvement.

Key Stages of Design thinking:

- Empathize (understanding empathic understanding of the problem we are solving).

In an effort to better understand the problematic faced by Coschool and their needs in their educational support program for the pedagogy of socio emotional skills, we participated in multiple interview and survey sessions with all of the organization active members; directing staff, educators, project leaders, and field teachers.

First, we had an interview with Felipe Moreno (*Innovation Director at Coschool foundation*) where it was possible to have a closer look at the methodologies used by Coschool in their projects, their vision, and future expectations for the interactive project. With his input, we laid out the framework for SEL and SES which give the project educational coherence.

We established our target user (*player*): students of all genders, 13 - 17 years of age, attending public schools in the city of Cali, which are currently involved with Coschool's projects and programs for socio emotional skill development. It became clear that our target demographic has knowledge and previous experiences related to SEL resultant of teaching methods that don't include emerging technologies.

Further on, we interviewed Juan Domingo Alvares (*project leader*) where we learned about past projects and the results of current ongoing projects, discerning which of these have generated more impact and engagement (such as school radio spaces, and Video Diaries of school events/dynamics). It became apparent how more traditional projects involving passive activities resulted in lower engagement levels, His testimony

backed our original assumption that prompts the use of emerging technologies as an opportunity for Coschool.

Mr Alvares allowed us to view his students' demographic and context in depth, where we understood that some of them come from compromised home environments, subject to violence or abuse. Said individuals have begun showing signs of affliction that manifest in uncooperative and problematic behavior in school and at home. It is important to note that despite not having most technologies within the household they are familiar with digital technology (computers, internet, smartphones, video games).

After surveying the team of field educators, where we inquired about their main challenges and emotional situations that their students face every day, it became clear that it is necessary to reinforce self-awareness topics and further their understanding of complex emotions that extend beyond the main emotional states (happy, sad, angry).

With the aim mitigating anger issues and bolstering strategies to cope and resolve manifestations of verbal and physical aggression.

- *Define: (Analyze and synthesize observations to define main necessities)*

We took the time to scrutinize our observations and based on our findings decided to focus the project on self-awareness and self-regulation, two tenants of SEL where work should be done to help students find equilibrium when facing challenges. We pinpointed a quintessential need to create immersive activities that motivate student participation resulting in seamless learning (experiential learning).

- *Ideate: (Generate ideas based on a solid background that solves a human-centered problematic)*

During this phase, we investigated emerging technologies such as: Virtual Reality and Augmented Reality, as well as, digital concepts that could favor teaching and knowledge absorption such as: gaming and digital worlds. With the purpose of determining the best course of action to build a digital experience that catered to the project's objectives, budget needs, user affordances and limitations, as well as deadlines. Coming up with a digital dynamic centered around self-recognition by placing the user in an active immersion environment coupled with rhythm gameplay (that appeals to a specific cultural context of the City of Cali widely known as "*the cradle of salsa music*").

Later on, it became necessary to investigate further and make a decision in regards to utilizing an appropriate platform. We researched digital construction possibilities that ranged from using AR cellphone based apps to developing for more robust hardware like VR goggles of the Oculus brand. We ended up choosing Oculus Quest because of its portability and also because it offered a higher degree of interactivity due to its motion controls, this meant that students would not only be immersed in a 360 environment but could interact with active gameplay mechanics via haptic remote controllers in both hands. This device aligns better with the students' needs for constant engagement and entertaining gaming mechanics, since it has a newer more powerful hardware the Quest opened the door to being able to create updated versions of this

demo with newer more complex features, making it the most suitable choice because it will allow the project to grow and adapt to future needs.

Next, we invited educators to a brainstorming session where everyone discussed the design based on their experience with students, we made decisions regarding aesthetic themes of the game, environment objects, interaction levels, difficulty setting and more importantly the role that music would play in the overall experience. The use of elements and instruments that had strong cultural relevance became a highlight of the session, integrating percussion instruments like marimba coupled with urban and tribal beats quickly became a desired feature. Linking the audio components of the game with the environment via gameplay was crucial to represent a state of constant transformation, an ecological theme filled with natural elements became ideal because it represented growth and constant change in a positive familiar setting. It was decided that the demo would be best suited as a support tool for face to face workshops where the instructor needed to guide students to a state of self-reflection before making an intervention at the end of an activity.

- *Prototype: Development History*

To start Development, we created a storyboard (see annex 1) and the first version of a prototype.

The storyboard:

In it we described the activity from beginning to end. Initial efforts hoped to create four different scenarios using common emotions (happiness, sadness, anger and fear)

and associate them to a weather change in the environment (drought, rainfall, forest fires, and fog). (see appendix 1.1 and appendix 1.2)

The player would follow a musical pattern, one per emotion, by playing the “marimba” (popular percussion instrument in Colombia similar to a xylophone) starting from a simple beat with slow tempo and increasing in difficulty as well as speed before returning to a sense of easiness like at the start. Creating a metaphoric relationship between appease the environment and managing the beat within the chosen climatic conditions.

At the end, the player would have the opportunity to create his/her own musical composition (free play) before progressing to the next emotion.

Prototype 1:

(created in unity version version 2019.3.12f1)

Coschools educators deliberated on this prototype and gave their opinion focusing on the need to have students recognize more complex emotions and distance their self-awareness experiences from basic emotions (happiness, anger, sadness), choosing instead to create an environment that would bolster the students emotional vocabulary in order for them to recognize deeper complex emotional states while managing the level of intensity and energy felt at any given moment.

While developing this version we identified issues and technical limitations that meant we had to simplify gameplay mechanics and replace certain elements. The Marimba having many keys created a level of difficulty because it required an unwanted level skill

and diminished visibility that hindered the experience for younger less capable players. We opted instead for having three flat striking surfaces for the incoming beat elements.

Altering multiple in game objects that existed in the environment required a different coding structure that exceeded our level of technical knowledge, instead we chose to use colors to represent the different emotional changes.

When the COVID-19 pandemic struck we decided to focus our resources in creating only one scenario centered around one emotion (anger) going from high intensity/energy to using breathing exercises to de-escalate the negativity, because this seemed particularly relevant to educators. We also chose to elongate the duration to approximately one minute (see appendix 2.1 and appendix 2.2).

This version focused strongly on the music composition with the purpose of evoking proper emotions belonging to the corresponding categorical group of a specific emotion known as “quadrant”. Applying emotional design theory to music we asked a Colombian composer to make use of folkloric instruments representative of the country’s culture such as marimba, cymbals and “guacharaca”, mixing them synthesizer and other modern sounds popular in modern urban music to create an instrumental composition that increases in rhythm and tempo exponentially to induce the sensation of stress which could provoke different emotions within our chosen quadrant (high energy, high intensity).

Prototype 2: created in Unity Platform Version 2019.3.12f1

For version two we tweaked various elements in the overall experience, difficulty settings, environment design and visual enhancements. At the peak of high intensity, having three strike surfaces altered the difficulty curve beyond our desired goal, making it impossible for players to reach a desired success condition (players must hit the surface in sync with the note of the song). It became necessary to modify the musical track's percussion to make the beat strike moments much more apparent to the player, while making the environment pulsate to the beat at the moment of striking. Synching visual pulses with sound (ED visceral principles).

Flat striking surfaces were replaced by 3D models of congas with a natural motif design, congas are a percussion instrument very relevant in Colombian composition. Controller models were replaced by colored hands, these changes made the action of playing more intuitive (ED behavioral principles), now the environment had tree models (taken from unity's free asset packages) that tied in with the forest theme of the scene.

Brighter colors were chosen, so the environment would gain a vibrant tone and the tree line was brought closer to the players position (see annex 3). All these changes created a cohesive environment that played off the strengths of its parts, with lights that stimulate visuals, colors and forms that are reminiscent of known objects for players as well as a gameplay mechanic dynamic enough to arouse curiosity but simple enough to be played instinctively.

The educational purpose of the experience is to help mitigate high energy responses to angry emotions, for this reason we added pauses in the track with breathing exercises (see annex 3.1). The player gets a break to diminish emotional intensity,

regains control of its emotional state and is then prompted by text in the UI (User Interface) to continue trying. The player goes through a brief peak of intensity with the purpose of eliciting frustration, then is prompted to take a break to breathe, take a minute to be introspective about his/her emotions and continues to play; fulfilling the workshop's pedagogical goals and learning via experience in a gaming environment.

To complete the demo, we added a free play section (ED Reflective principles) where players, after having completed their experience, can play independently based on the sensations and emotions felt during the activity allowing them a space of free expression and release before ending the session.

Further Developments

The COVID-19 pandemic hit the world by surprise and forced everyone to adapt development to meet a standard of safety and distancing to stop viral spread. In the original development plan, we conceived multiple rounds of testing for particular aspects and at particular stages of creation, which we were unable to do.

In the future, it would be important to go to the city of Cali and test the experience in action, to hear students and see their reactions live. Despite always having educators and teachers in mind we know it's still essential to go through the student's experience with them. Taking on the journey allows us to see the project's real affordances and requirements, including simple things that wouldn't normally be an issue but could be important in the application of the workshops, for example: heat, constant access to

power, or some other unknowns we may have overlooked completely. However, the testing stage may be developed by Coschool following a guide we provide, and taking in account different legal measurements such as forms to get consent from parents and guardians in order to get results and insights from minors.

It will also be necessary for further development of the project to consult with programmers to calculate the amount of work and cost necessary to bring our project from demo to at least beta stage complete game.

In terms of creation we intent to add a particular set of features that presumably could enhance the experience for players:

- Community co-creational development

We believe that emotional development/learning benefits not only from introspection but also from sharing and co-creating growth experiences that could serve as testimony or motivation for others. Since “Hearttune” has a strong musical component we dream that at some point we will be able to create robust compositions of varied instruments inspired by players' interactions with their emotions.

Along with this same line of thinking we would also like to add a co-operative mode that encourages classmates to play together, prompting them to learn from each other and motivating them to complete the exercises while enjoying a joint experience.

It is our belief that integrating prosocial components into the experience will impact the learning process and make for a lasting experience.

Conclusions

Research confidently backs the idea that VR can be a valuable tool in processes of emotional learning, especially in places of conflict and social distress. Young people will prove particularly receptive to this technology and need to be introduced responsibly to mitigate negative effects that could impact their health or turn VR into a source of addiction.

Colombia's many conflicts have yielded, and still bring, many issues that potentially threaten young developing children. It's extremely important to implement innovative solutions that specifically target socio emotional development for people of all ages. Implementing frameworks like CASEL and integrating workshops as part of the main educational curriculum is quintessential to maintaining mental health. The pandemic currently struck Colombia and the country is struggling harder than most to cope with its consequences, the lack of technical implementation is evident during these times and people can no longer keep their jobs. regardless of its cost it is important to normalize the usage of emerging technologies that fortify our infrastructure.

The usage of VR could be seen like a novelty at this moment but just like the internet a few decades ago it could quickly grow to become fundamental for everyone. Efforts must be made to bring more of this industry to underdeveloped countries as it could also become a source of job generation. VR and other remote technologies allow us to share experiences in a unique way that increase our levels of empathy with others whose stories can enlighten us to larger truths, it is my hope that in realizing this project

we not only benefit Colombia but in turn will also be able to bring to light the emotions and life stories of its people for the rest of the world.

Members of struggling communities, especially children, can be an inspiration to people living in other totally different life conditions. We wish to bring to practice the idea of exchanging life experiences through immersive learning.

Appendix A

Figure 1-A Happy scenario with marimba as controller

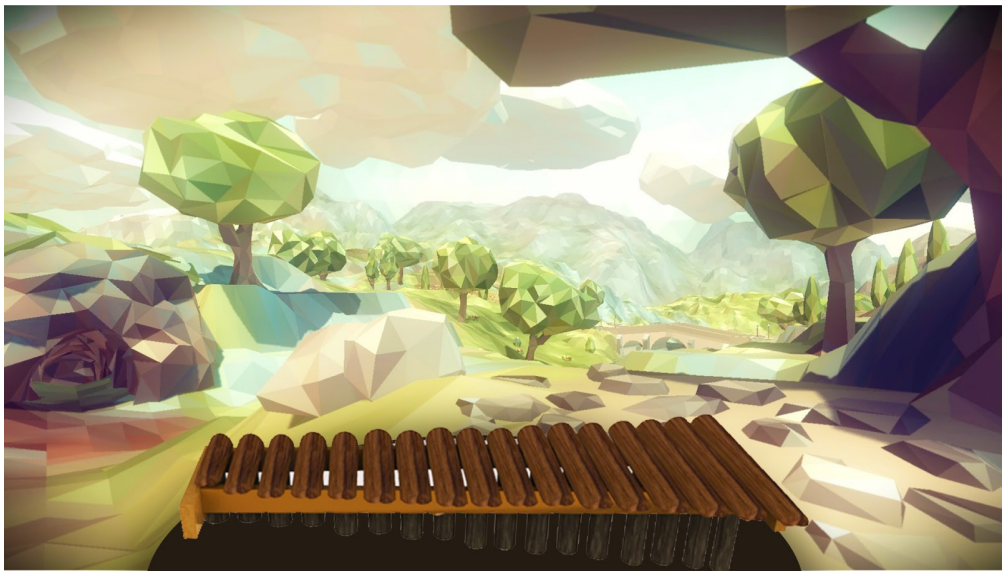

Figure 1-A Happy Scenario with Marimba as Controller

Figure 1-B Sad scenario with marimba as controller

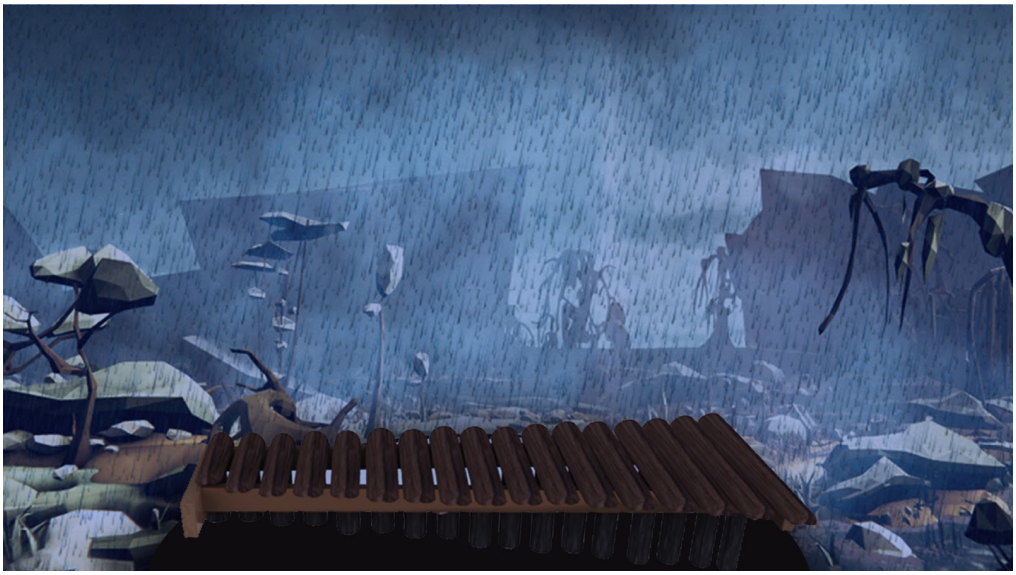

Figure 1-B Sad scenario with marimba as controller

Appendix B

Prototype 2

Figure 2-A Strike surfaces

Figure 2-B Target Flow

Appendix C

Modelling

Figure 3-A 3D Conga Modeling

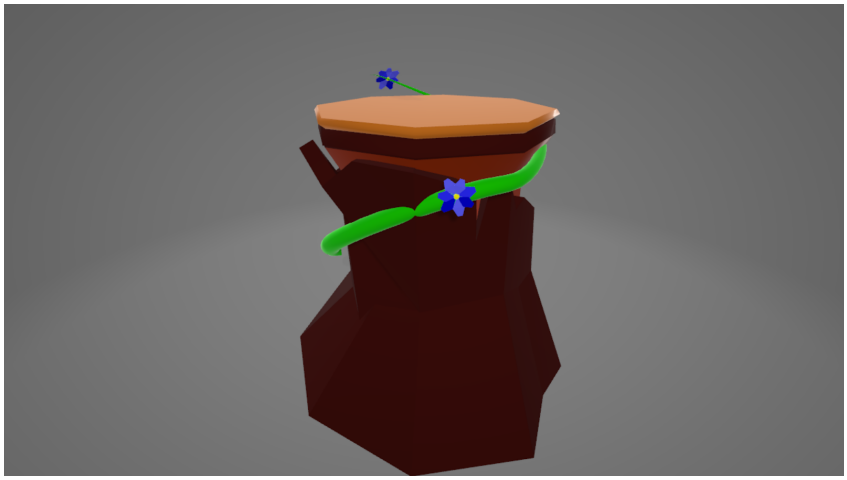

Figure 3-A 3D Conga Modelling

Bibliography

Attanasio, O., Fitzsimons, E., Gomez, A., Gutiérrez, M. I., Meghir, C., & Mesnard, A. (2010). Children's Schooling and Work in the Presence of a Conditional Cash Transfer Program in Rural Colombia. *Economic Development and Cultural Change*, *58*(2), 181–210. https://doi.org/10.1086/648188

Ayure, J. R. D. (2017). EMOCIONES, CONFLICTO ARMADO Y REALIDAD VIRTUAL. INTRODUCCIÓN AL USO DE AMBIENTES VIRTUALES EN COLOMBIA. *PONTIFICIA UNIVERSIDAD JAVERIANA FACULTAD DE PSICOLOGÍA*, 96.

Balkwill, L.-L., Thompson, W. F., & Matsunaga, R. (2004). Recognition of emotion in Japanese, Western, and Hindustani music by Japanese listeners [1]: Recognition of emotion in music. *Japanese Psychological Research*, *46*(4), 337–349. https://doi.org/10.1111/j.1468-5584.2004.00265.x

Caldas, O. I., Aviles, O. F., Rodríguez-Guerrero, C. (2020). Effects of Presence and Challenge Variations on Emotional Engagement in Immersive Virtual Environments. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, *28*(5), 1109–1116. https://doi.org/10.1109/TNSRE.2020.2985308

Casel.org. (2015). *Casel-secondary-guide.pdf*. 2015 CASEL Guide: Effective Social and Emotional Learning Programs—Middle and High School EditionPage 46Collaborative for Academic, Social, and Emotional Learning. http://secondaryguide.casel.org/casel-secondary-guide.pdf

Casel.org. (2020). *What is SEL?* Casel.Org. https://casel.org/what-is-sel/

Chen, S. H., & Zhou, Q. (2019). Cultural Values, Social Status, and Chinese American Immigrant Parents' Emotional Expressivity. *Journal of Cross-Cultural Psychology*, *50*(3), 381–395. https://doi.org/10.1177/0022022118817653

Del Risco Bravo, C. S. (2014). Conflict and Child Labor: Evidence from Poor Households in Colombia. *Economics and Finance*, 18.

Dirección Nacional de Estupefacientes. (2008). *Estudio nacional de consumo de sustancias psicoactivas en Colombia 2008: Informe final.* Ministerio de la Protección Social.

Donald A. Norman. (2004). *Emotional Design, Donald Norman*. Basic Books.

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The Impact of Enhancing Students' Social and Emotional Learning: A Meta-Analysis of School-Based Universal Interventions: Social and Emotional Learning. *Child Development*, *82*(1), 405–432. https://doi.org/10.1111/j.1467-8624.2010.01564.x

Fleck, B. K. B., Beckman, L. M., Sterns, J. L., & Hussey, H. D. (2014). *YouTube in the Classroom: Helpful Tips and Student Perceptions*. *14*, 17.

Germonprez, M., Hovorka, D., Bond University, Gal, U., & University of Sydney. (2011). Secondary Design: A Case of Behavioral Design Science Research. *Journal of the Association for Information Systems*, *12*(10), 662–683. https://doi.org/10.17705/1jais.00278

Government of Canada, S. C. (2020, April 8). *How are Canadians coping with the COVID-19 situation?* https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2020029-eng.htm

Hunter, P. G., & Schellenberg, E. G. (2010). Music and Emotion. In M. Riess Jones, R. R. Fay, & A. N. Popper (Eds.), *Music Perception* (Vol. 36, pp. 129–164). Springer New York. https://doi.org/10.1007/978-1-4419-6114-3_5

Juslin, P. N., & Västfjäll, D. (2008). Emotional responses to music: The need to consider underlying mechanisms. *Behavioral and Brain Sciences*, *31*(5), 559–575. https://doi.org/10.1017/S0140525X08005293

Kamil, M. J. M., & Abidin, S. Z. (2013). Unconscious Human Behavior at Visceral Level of Emotional Design. *Procedia - Social and Behavioral Sciences*, *105*, 149–161. https://doi.org/10.1016/j.sbspro.2013.11.016

Kolb, D. A., Boyatzis, R. E., & Mainemelis, C. (2014). Experiential Learning Theory: Previous Research and New Directions. In R. J. Sternberg & L. Zhang (Eds.), *Perspectives on Thinking, Learning, and Cognitive Styles* (0 ed., pp. 227–248). Routledge. https://doi.org/10.4324/9781410605986-9

Laukka, P., & Gabrielsson, A. (2000). Emotional Expression in Drumming Performance. *Psychology of Music*, *28*(2), 181–189. https://doi.org/10.1177/0305735600282007

Longman-Mills, S., González, Y. W., Meléndez, M. O., García, M. R., Gómez, J. D., Juárez, C. G., Martínez, E. A., Peñalba, S. J., Pizzanelli, M. E., Solórzano, L. I., Wright, G. M., Cumsille, F., Sapag, J. C., Wekerle, C., Hamilton, H. A., Erickson, P. G., & Mann, R. E. (2011). Child Maltreatment and Its Relationship to Drug Use in Latin America and the Caribbean: An Overview and Multinational Research Partnership. *International Journal of Mental Health and Addiction*, *9*(4), 347–364. https://doi.org/10.1007/s11469-011-9347-0

Mayer, R. E., & Estrella, G. (2014). Benefits of emotional design in multimedia instruction. *Learning and Instruction*, *33*, 12–18. https://doi.org/10.1016/j.learninstruc.2014.02.004

Mohn, C., Argstatter, H., & Wilker, F.-W. (2011). Perception of six basic emotions in music. *Psychology of Music*, *39*(4), 503–517. https://doi.org/10.1177/0305735610378183

Moore, K. S. (2013). A Systematic Review on the Neural Effects of Music on Emotion Regulation: Implications for Music Therapy Practice. *Journal of Music Therapy*, *50*(3), 198–242. https://doi.org/10.1093/jmt/50.3.198

OECD org. (2016). *Education in Colombia | READ online*. OECD ILibrary. https://read.oecd-ilibrary.org/education/education-in-colombia_9789264250604-en

Oleksandr S. Chernyshenko, Miloš Kankaraš, & Fritz Drasgow. (2018). *Social and emotional skills for student success and well-being: Conceptual framework for the OECD study on social and emotional skills* (OECD Education Working Papers No. 173; OECD Education Working Papers, Vol. 173). https://doi.org/10.1787/db1d8e59-en

Osorio Mejía, A. M., & Aguado Quintero, L. F. (2018). *El estado de la niñez en Cali: Una mirada por comunas*. http://www.digitaliapublishing.com/a/55099/

Peña Castañeda, C. (2019, November 10). *Colegios virtuales, plan de Facebook para combatir el matoneo escolar*. El Tiempo. https://www.eltiempo.com/vida/educacion/colegios-virtuales-el-plan-de-facebook-para-combatir-el-matoneo-escolar-432298

Posso Chaparro, M. I., Chica Velásquez, M. F., Gallego, S. M. (2017). Impacto psicológico de niños expuestos a la violencia de forma directa e indirecta de dos casas de protección del ICBF y de una institución educativa de la ciudad de Cali, Colombia. *Desbordes. Revista de Investigaciones. Escuela de Ciencias sociales, artes y humanidades - UNAD*, *6*, 19. https://doi.org/10.22490/25394150.1861

Rizzo, A., John, B., Newman, B., Williams, J., Hartholt, A., Lethin, C., & Buckwalter, J. G. (2013). Virtual Reality as a Tool for Delivering PTSD Exposure Therapy and Stress Resilience Training. *Military Behavioral Health*, *1*(1), 52–58. https://doi.org/10.1080/21635781.2012.721064

Rolston, A., & Lloyd-Richardson, E. (2017). What-is-emotion-regulationsinfo-brief.pdf. *Cornell Research Program*. http://www.selfinjury.bctr.cornell.edu/perch/resources/what-is-emotion-regulationsinfo-brief.pdf

Scozzari, S., & Gamberini, L. (2011). Virtual Reality as a Tool for Cognitive Behavioral Therapy: A Review. In S. Brahnam & L. C. Jain (Eds.), *Advanced Computational Intelligence Paradigms in Healthcare 6. Virtual Reality in Psychotherapy, Rehabilitation, and Assessment* (Vol. 337, pp. 63–108). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-17824-5_5

Sel Practices. (2020, accessed). *Emotion Management*. SEL Thrive. https://www.selpractices.org/domain/emotion-management

Sengers, P., Boehner, K., David, S., & Kaye, J. "Jofish." (2005). Reflective design. *Proceedings of the 4th Decennial Conference on Critical Computing between Sense and Sensibility - CC '05*, 49. https://doi.org/10.1145/1094562.1094569

Servotte, J.-C., Goosse, M., Campbell, S. H., Dardenne, N., Pilote, B., Simoneau, I. L., Guillaume, M., Bragard, I., & Ghuysen, A. (2020). Virtual Reality Experience: Immersion, Sense of Presence, and Cybersickness. *Clinical Simulation in Nursing*, *38*, 35–43. https://doi.org/10.1016/j.ecns.2019.09.006

Stolzer, J. M. (2016). The meteoric rise of mental illness in America and implications for other countries. *The European Journal of Counselling Psychology*, *4*(2), 228–246. https://doi.org/10.5964/ejcop.v4i2.77

Swaminathan, S., & Schellenberg, E. G. (2015). Current Emotion Research in Music Psychology. *Emotion Review*, *7*(2), 189–197. https://doi.org/10.1177/1754073914558282

Torres, L. A. (2020, Junio 22). *Pandemia del feminicidio: 99 mujeres asesinadas en lo corrido del 2020* [Casa Editorial el Tiempo]. El Tiempo. https://www.eltiempo.com/bogota/pandemia-del-feminicidio-99-mujeres-asesinadas-en-lo-corrido-del-2020-509910

Trehub, S. E. (2003). The developmental origins of musicality. *Nature Neuroscience*, *6*(7), 669–673. https://doi.org/10.1038/nn1084

United Nations. (2020, May 13). *UN-Policy-Brief-COVID-19-and-mental-health.pdf*. https://unsdg.un.org/sites/default/files/2020-05/UN-Policy-Brief-COVID-19-and-mental-health.pdf