

Learning is an interesting process where discoveries are made by the learner, discoveries that can transform them, how they view their world and the impacts that can be made with the knowledge gained – usually the results of such learning. Sadly, most learning experiences are not as exciting for most learners, particularly when they subject doesn't know how to learn, not necessarily because the subject can't learn but hasn't approached learning from a means that best fits their interest or unique needs. Growing up, learning certain subjects came much easier for me than others. Subjects like geography, art and biology – or any subjects where images were available for me to see, made the learning much more interesting. I noticed I struggled a lot and found more abstract subjects like mathematics where numbers existed on a plain white background, covered with blue grid lines a challenge to comprehend because I couldn't visualize what these numbers represented in the real world or how they could be meaningful to me (at the time of course). Interestingly, I noticed that subjects which I did enjoy posed a threat themselves when I reached areas void of any graphical representation and offered nothing but a long body of alphabets and punctuation marks. I wasn't the only one trapped in this dilemma, many fellow young learners couldn't grasp the point of numbers in the real world and what they even meant for that matter. This led me to think and imagine – if only everything could be illustrated and exist as art.

Learning however has come a long way since the days of just textbooks and blackboards. With the creation of the world wide web and search engines like google access to information can be done without a given it a second thought. The rise of AI also opens a new window to learning. Experience technology such as Virtual and Augmented reality are also fast becoming key players in the education field. These innovations are the forces that shape the way we learn (#8).

With all these technology at our disposal, it made me begin to imagine the possibilities of bridging the learning divide particularly for learners such as myself who were more visually inclined. I began exploring concepts and ideas of having abstract concepts visualised in 3D and easily displayed through mobile devices easily accessible when and where needed. This led to the birth of my project ARE – Augmented Reality Education.

The purpose of ARE project is a simple one, make learning an exciting experience for learners by simplifying complex abstract concepts through 3D visuals while attracting and maintaining their attraction through engagement. With this in mind, I was faced with a question which would ultimately define my work: How could learners be engaged with learning complex abstract subjects through Augmented reality, compelling visual designs and user interaction?

ARE is an augmented reality application that serves both as an experience and learning tool. 3D contents are generated on a mobile device which learners can engage with through screen-touch interactions. During planning, mathematics was chosen as the abstract subject to be visualised; an additional subject was also chosen to explore additional features towards learner engagement and learning. The experience was developed using Unity and Vuforia engine for android mobile devices.

To properly plan out and implement my design, I approached the project as a software development task following the Software Development Life Cycle process model, utilising the Agile method variation. Testing was crucial for the entire development timespan, thus I implemented a Test-driven development.

During the course of the project, I discovered very quickly the broad scope of the work that developing visual content for abstract subject would create, hence I decided to focus on attraction, engagement

through visuals and interactions. This critique will focus on my approach gaining the learner attraction and promoting active learning through interactions. Additionally, limitations to the project as it relates to certain design choices and how this affected the outcome of the developed tool will also be addressed.

CLUE/TIP/HINT: - rewrite to express what I will write about in this paper, use Domniques paper as a reference