Augmented Reality has a history that spans several years, during which it has undergone progress and refinement in line with advancements in technology. Early implementations of AR have been in projects revolving around scientific and military use (ref #1). Augmented reality can be defined broadly as the integration of digital content with the physical world in a seamless manner. (ref #11). (Ref #3) alter our AR perspective with new insights into its current and future use. According to (Ref #3) AR adds computer-generated objects to the real world, providing sensory experiences beyond sight, such as smell, touch, and taste, in real-time. Research by (Ref #5) argues that to fully comprehend the concept of AR, it is imperative to acknowledge that its definition goes beyond the visual sense and encompasses the ability of AR to engage other senses as mentioned earlier. It is possible to imagine the endless potential of AR technology across multiple industries. One major application of AR technology is in advertising and marketing. Marketing campaigns have evolved to provide an immersive experience, allowing customers to interact with digital models of real-world products such as cars and toys. (Ref #11). Users can view products from different angles and sizes using hand gestures based on their interaction preferences. (Ref #2) provides more examples of AR applications in medical science-based fields where Collaborative AR interfaces could be integrated with medical practices for surgeries and medical diagnosis.

AR technology, in existence for over two decades, is still considered a developing medium in its initial stages, according to (Ref #11). Developing functional AR applications, as emphasized by (Ref #4), necessitates a diverse skill set encompassing both artistic and technical abilities. (Ref #10) agrees, noting that the limited research on AR in education restricts our understanding of its feasibility and accessibility in the educational field. Nonetheless, (Ref #10) highlights numerous benefits of AR in enhancing student learning, transforming passive learning into an interactive and engaging experience.

AR's advantage lies in its ability to incorporate digital content from various sources, including 3D assets, infographics, and audiovisual materials. An evaluation of a BBC-developed AR learning application demonstrated that 3D models and characters can generate excitement among young learners. The BBC AR experience, based on a storybook model, allowed users to trigger 3D content by holding up a book or printed card to a webcam-enabled device. Results indicated active engagement, with 98% of children interacting with characters and 93% enjoying both characters and written content. Overall, the positive response illustrates one of the educational benefits that AR can provide.

Augmented reality (AR) can positively impact learners' performance, particularly in comprehending challenging, abstract concepts that often discourage students from science-based subjects (Ref #10). The mode of presentation significantly influences interest and engagement in learning, as noted by (Ref #10), emphasizing the boredom and disengagement associated with traditional chalk-and-board lecturing. Supplementary research from (Ref #13) underscores AR's utility in enhancing motivation for learning. When used as a complementary source alongside physical content, AR visualizations for abstract concepts improve student comprehension, reducing reliance on imagination alone. The study (Ref #13) reports a 53.3% improvement in learning performance, accompanied by a 28.1% increase in motivation and a 15.6% rise in engagement through AR applications.

Notwithstanding its advantages, the integration of AR technology in educational settings is constrained by certain limitations. AR systems rely on camera and marker recognition for model placement, leading to extended wait times when markers are inaccurately identified, causing user uncertainty about the application's effectiveness. This circumstance, as evidenced in (Ref #13), frequently results in user frustration. Furthermore, as noted in (Ref #14), the indeterminate value of AR applications arises from variances in their assessments of the benefits of learning outcomes.