Kiddo Sains AR

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***Abstract*— The Malaysia's early scientific education is severely lacking in interactive and interesting learning materials for primary level 1 children (ages 7 to 9). To close this gap, Kiddo Sains AR has developed a cutting-edge Augmented Reality (AR) platform that improves science education by using easy, hands-on experiments tailored for young students. The importance of encouraging curiosity, critical thinking, and STEM abilities has grown as Malaysia moves away from traditional tests like the UPSR and towards a more experience-based educational approach. Beyond the confines of traditional classroom environments, Kiddo Sains AR enables children to explore and study science in an interesting and approachable way by converting abstract scientific topics into interactive virtual experiments. The study's main goals are to create an interesting science platform, analyze the influence of AR-based learning on students' comprehension and interest in STEM, and determine how effective AR-based learning is. To methodically design, build, and test the platform, the study adheres to the ADDIE instructional design methodology. According to preliminary research, Kiddo Sains AR greatly enhances students' understanding of scientific concepts and participation. But issues like device compatibility and accessibility need further work. Overall, this study shows how AR could completely transform early scientific education in Malaysia by giving young children more engaging, enjoyable, and productive learning experiences.**

I. INTRODUCTION (HEADING 1)

An interactive Augmented Reality (AR) platform called Kiddo Science AR was created to improve early science instruction for Malaysian primary Level 1 pupils, who are between the ages of 7 and 9. This project responds to the growing demand for easily accessible and interesting educational resources that complement Malaysia's transition to a more experiential and holistic approach to education. The platform lets kids explore, experiment, and learn through play by turning abstract ideas from the national primary science curriculum into virtual experiments. Kiddo Science AR helps young learners visualize and comprehend scientific concepts that are frequently challenging to understand through traditional means by providing straightforward, interactive projects spanning areas including physics, chemistry, and life sciences.

In a safe and engaging setting, kids may solve science-based questions, mix virtual chemicals, experiment with magnetism, and watch plant growth cycles. Animated characters who lead students through science adventures and introduce ideas like life cycles, states of matter, and fundamental chemical reactions are incorporated into the platform to enhance student engagement. Children are inspired to make choices and observe results in real time by these characters, which develops their curiosity, critical thinking, and interest in STEM fields.

Kiddo Science AR, which is available on several platforms, enhances the fun and approachability of science instruction in both the home and school. The platform fosters a lifetime interest in learning and helps children improve their problem-solving abilities by fusing play, storytelling, and interaction. Finally, by motivating a new generation of inquisitive, talented students and providing a solid basis for future STEM education, Kiddo Science AR advances Malaysia's educational objectives.

II. LITERATURE REVIEW

A. Pedagogical Approaches for Teaching Early Experiment Through AR

Early scientific education is greatly enhanced by Augmented Reality (AR), which skillfully blends inquiry-based learning with repetition-based reinforcement to produce a thorough and engaging learning environment. Through real-time interaction, visualization, and virtual experimentation, AR enables students to actively engage with scientific concepts, promoting critical thinking, curiosity, and self-directed discovery. In a secure and stimulating setting, kids may ask questions, make predictions, test theories, and experience scientific events up close—all of which enhances their comprehension and fosters a sincere interest in science. Additionally, by allowing students to revisit experiments several times, each with fresh interactive

components or challenges that reinforce knowledge, augmented reality (AR) promotes recurrent exposure to fundamental scientific concepts.

In addition to strengthening understanding, this cyclical learning process boosts self-esteem and encourages long-term memory of fundamental ideas like motion, states of matter, and fundamental chemical interactions. AR-enabled inquiry and repetition promote active problem-solving and the development of cognitive skills, which makes scientific learning fun and efficient for young students. All things considered, AR is a potent instrument that connects theoretical information with real-world comprehension, meeting the many learning preferences and developmental requirements of early childhood education.

B. Challenges and Limitations of AR in Early Science Experiment Education

A careful balance between entertainment and educational value is necessary when creating an AR-based science curriculum for young children. This way, immersive features, interactive challenges, and animations can all be used to enhance learning without taking away from the main scientific ideas. The interactive features of AR can greatly increase student interest and engagement, but it's important that these enjoyable elements don't take attention away from the learning objectives. It is equally crucial to match the user interface, content, and overall experience to the early learners' stages of cognitive development. Because young children have short attention spans and poor cognitive skills, complex visuals, a lot of information, or unclear interactions can make learning more difficult and less successful.

As a result, employing straightforward, understandable graphics and digestible information loads that correspond with children's developmental stages, experiments, activities, and AR content must be carefully modified to be age appropriate. Augmented reality (AR) learning tools can offer relevant, accessible, and effective science education that engages young learners while fostering their comprehension and curiosity by carefully blending appealing entertainment with suitable instructional content and taking cognitive preparedness into account. To guarantee that AR supports long-term learning outcomes and has the greatest possible influence on early childhood education, a careful approach is necessary.

C. The Impact of AR on Science Learning in Preschool

Young children's science education can be revolutionized by Augmented Reality (AR), which transforms abstract scientific ideas into interactive, tangible experiences that are much more approachable and captivating than conventional teaching techniques. For young students who are still developing their cognitive and sensory skills, traditional classrooms frequently rely on textbooks, diagrams, and spoken explanations. Augmented Reality (AR) fills this gap by fusing the actual and virtual worlds to create immersive, multisensory learning experiences. AR enables children to visualize and investigate scientific events in real time by letting them interact with 3D models, such as planets circling in space or organs functioning within the human body.

This practical experience fosters critical thinking abilities, curiosity, and experimentation by allowing students to pose questions, develop hypotheses, and actively test their theories—all of which are modelled after the scientific method. Additionally, the multimodal approach of AR—which combines visual, auditory, and kinesthetic learning—accommodates a variety of learning styles and improves comprehension and retention, especially for preschoolers who have trouble with instruction that is solely text-based or aural. Because early childhood cognitive development is variable, AR also facilitates personalized learning by letting kids interact with the content at their own speed, repeating difficult subjects or moving on as they grasp new ideas.

AR not only helps students grasp scientific concepts more deeply but also develops a lifelong interest and passion for STEM subjects by making science education more dynamic, relatable, and customized to each student's needs. All things considered, augmented reality (AR) is a potent teaching tool that transforms how young students encounter science by encouraging engagement, significant discovery, and the development of fundamental abilities that foster scientific curiosity and lifetime learning.

III. RESEARCH METHODOLOGY

Any educational technology project must have a structured instructional design model to be successful since it guarantees a methodical approach to organising, creating, and assessing learning experiences. The ADDIE Model, which consists of five stages—analysis, design, development, implementation, and evaluation—was used in the Kiddo Sains AR project. The development of an efficient Augmented Reality (AR) learning platform that aims to improve scientific instruction for seventh- and ninth-grade primary school students was based on this paradigm.

This chapter demonstrates how the ADDIE method significantly raised the platform's degree of engagement, content quality, and usability. The project's direction was determined by evaluating user demands, curriculum requirements, and technology maturity during the analysis phase. Storyboards, user interfaces, and matching scientific ideas with age-appropriate augmented reality information were all planned during the design phase.

Using Unity, Blender, and Vuforia, interactive 3D models, animated elements, and augmented reality simulations were produced during the development stage. Students used mobile devices to interact with the AR book during the Implementation phase, which introduced the AR platform in authentic classroom environments. In order to measure learning results and user satisfaction, the evaluation phase finally integrated observations, usability testing, pre- and post-assessments, and feedback from parents, teachers, and students.

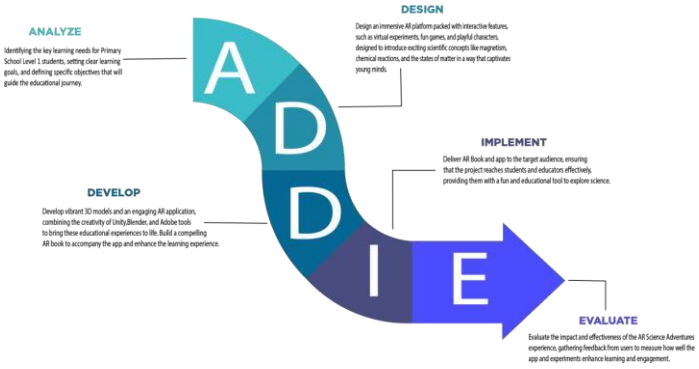

Figure 1: ADDIE model

The project made sure that the finished result was not only useful and accessible but also had an impact on encouraging young learners' curiosity, critical thinking, and scientific understanding by integrating qualitative and quantitative methodologies within the ADDIE framework. An organised and captivating AR learning tool designed for early STEM education was produced because to the ADDIE Model's ability to provide a focused but adaptable development cycle.

A. Analysis Phases

The primary goal of this phase is to determine the essential learning needs of Level 1 primary school students, who are seven to nine years old. Analysing their cognitive capacities, developmental stage, and current scientific understanding are all part of it. To identify the fundamental scientific ideas that should be taught at this level, the curriculum is examined. Clear, age-appropriate learning objectives that are in line with local or national standards are established as a result. These goals are to develop a fundamental understanding of science and to stimulate curiosity. The learning process is then guided by specific goals, such as improving understanding of chemical reactions and magnetism, and the AR platform is made sure to support each aim.

B. Design Phases

An immersive augmented reality (AR) platform will be created during the design stage to keep young students interested. Interactive features like games, virtual experiments, and animated characters that bring scientific ideas to life will be included in the platform. With the help of these qualities, subjects like states of matter, magnetism, and chemical reactions should become both entertaining and instructional. The design will allow kids to explore and learn at their own pace by emphasizing simplicity, clear visual clues, and a sense of wonder.

C. Develop Phases

The development phase will concentrate on using Unity and Blender to create dynamic 3D models and an interesting, augmented reality (AR) application. These interactive models will demonstrate scientific ideas like magnetism, chemical reactions, and states of matter. The AR software will be made to run smoothly and allow for simple user engagement. Children will also be able to scan pages of a companion augmented reality book to access interactive activities and virtual material. This technological integration attempts to offer a creative and engaging science education.

D. Implement Phases

The AR book and app will be distributed to Level 1 Primary School children and their teachers throughout the deployment phase. Reaching the target audience effectively and ensuring accessibility are the objectives. This entails giving teachers access to appropriate gadgets, like smartphones or tablets, and assisting them in incorporating the app into their classes through training. Usability and efficacy will be prioritized to provide a seamless, interesting, and instructive augmented reality experience for science teaching.

E. Evaluation Phases

The assessment of the Kiddo Sains AR experience's impact and efficacy will be the main goal of the evaluation phase. Surveys, interviews, and observations will be used to collect feedback

from teachers and students to gauge gains in participation, comprehension of scientific ideas, and the growth of critical thinking and problem-solving abilities. Interest in science, usability, functionality, and general enjoyment will be important evaluation factors. The knowledge acquired will direct future developments, guaranteeing that the AR platform adapts to better suit user requirements.

IV. RESULTS AND DISCUSSION

Figure 2: Target Audience Understanding of the Content (Children Aged 7–9 Years)

This chart shows the responses to the query, "Is the content easily understood by the target audience (children aged 7–9 years)," All 30 respondents (100%) chose "Yes," indicating that the content was well-designed and suitable for younger pupils. The result shows how effectively the language, graphics, and interactive elements contributed to the kids' understanding of the material. This positive response suggests that the content is suited for elementary school use and encourages early science learning through engaging and age-appropriate design.

Figure 3: Effectiveness of Animation and Movement in Attracting and Maintaining Children's Attention During Learning

Figure 3 illustrates how effectively animation and movement can capture and maintain children's interest throughout the learning activities in the program. The majority of respondents (60%) rated this factor as having the highest level of attention (Level 5), indicating a strong consensus that movement and animation greatly help to keep children's attention. Furthermore, it received a Level 4 rating from 26.7% of respondents, while only 6.7% gave it a Level 3 or Level 2 rating. This suggests that a large number of people think it's a good idea to employ animation and movement to increase kids' attention and involvement during the learning process.

Figure 4: Perceived Potential of the Project for Widespread Use in Primary Schools

Figure 4 shows respondents' perceptions of the project's chances of being broadly implemented in elementary schools. 22 (73.3%) of the 30 respondents rated the project as Level 5, demonstrating a high degree of trust in its suitability and effectiveness in educational settings. Additionally, it received a Level 3 rating from three respondents (10%) and a Level 4 rating from five respondents (16.7%). These findings suggest that the program is very promising and has a high likelihood of being effectively incorporated into primary school curricula.

V. DISCUSSION

The results of the questionnaire and tests show that the AR Book Kidney Cancer campaign was successful. The prototype was found to be practical, user-friendly, and effective in delivering a noteworthy 3D augmented reality experience. There were no known testing failures, and the feedback from respondents was largely positive. This indicates that the AR-based learning tool was not just a fun and educational resource but also increased user engagement. The findings support the objectives of the study by demonstrating that augmented reality (AR) can provide children with an interesting and interactive way to learn about science, that virtual interaction can improve science investigations, and that AR-based experiments increase first-grade students' interest in and understanding of science subjects.

VI. CONCLUSION

A creative and useful tool for raising kids' interest and comprehension in science education is Kiddo Sains AR. The app provides educational knowledge in an interesting and approachable manner by fusing 3D graphics, games, interactive tests, and augmented reality. According to user comments, science concepts are better understood, and interactive activities and features like the Scan AR function make learning more entertaining and memorable. The study emphasises AR's great potential in education when combined with careful content design, despite certain technical issues. Future improvements like additional material, accessibility choices, and wider device compatibility might increase its impact even more and lay the groundwork for AR-based learning's continued development.

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