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An Augmented Reality-Based Educational Android Application for Children with Intellectual Disabilities

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ABSTRACT

In This paper, we've covered the fundamentals of augmented reality as well as its uses in the field of education for kids with special needs and learning difficulties. Traditional learning is given an extremely interactive, engaging, and informative element via augmented reality. It enables the blending of a wide range of multimedia objects, including three- dimensional object models, movies, audio files, and photographs. We have also discussed the many learning difficulties and how this educational tool works as a better educational tool to help you grasp it goal in greater detail. various children have various educational needs depending on the type of learning disability. Based on application elements like colors and the interaction interface, etc., some disabilities cause users to experience a range of emotional reactions. Therefore, the design and interface of instructional tools aimed at these kids must be given extra consideration. Its performance capacity and current position as a technology-focused educational tool in India are given particular attention. By developing a prototype teaching tool to meet the demands of various educational institutions and putting it to the test in an experimental class to determine its impact and limitations, we have shown this. Our instructional tool covers a wide variety of concerns that must be considered when creating educational materials for kids with certain learning difficulties. In this paper, we outline the exact elements of our application that we used to complete the requirements for a teaching tool that works with a particularly sensitive group of learners.

Keywords – Augmented Reality; Learning Management System; Learning Disability. Cognitive Disability; Moodle Course Management.

1. INTRODUCTION TO AUGMENTED REALITY

Augmented Reality (AR) is the real-time integration of digital content into the user's physical surroundings. Unlike Virtual Reality (VR), which creates an entirely simulated environment, AR enhances real-world experiences by overlaying perceptual digital elements. This technology allows users to interact with their environment while receiving additional information or modified visual elements. A key advantage of AR is its ability to blend three-dimensional (3D) digital components with human perception of reality, with applications ranging from entertainment to decision-making support [1].

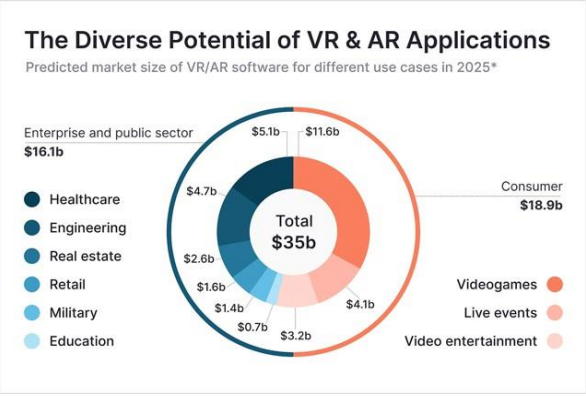


Fig.1 Predicted Market Size of VR/AR Software for different use cases in 2025

AR delivers visual, auditory, and other sensory enhancements through devices such as smartphones and smart glasses. This digital information is superimposed onto a user's view, altering their perception of the real world. The technology can modify a natural environment by adding or concealing certain elements [2].

The term "augmented reality" was first introduced by Thomas Caudell, a researcher at Boeing Computer Services Research, in 1990. He used it to describe the use of head-mounted displays by electricians to assemble complex wiring systems. One of the earliest commercial applications of AR was

the yellow first-down marker in football broadcasts, which appeared in 1998. Today, AR is widely used in consumer devices like Google Glass, smartphone-based games, and heads-up displays (HUDs) in car windshields. Additionally, industries such as healthcare, public safety, energy, tourism, and marketing leverage AR for various purposes [3].

AR technology can be experienced through different platforms, including smartphones, tablets, and AR eyewear. Researchers are also exploring the potential for AR-enabled contact lenses. The hardware required for AR includes processors, sensors, displays, and input devices, many of which are already built into modern mobile devices. These components—such as cameras, accelerometers, GPS, and compasses—enable AR to be accessible to everyday users [4].

1.1 UNDERSTANDING LEARNING DISABILITIES AND CHILD DEVELOPMENT

The term "learning disability" (LD) is a broad classification used to describe specific learning challenges. Individuals with LD may struggle to acquire and apply certain skills, including reading, writing, listening, speaking, reasoning, and mathematics. However, each person with a learning disability is unique and may face different challenges. For example, one person might struggle with both reading and writing, while another may have difficulty with math comprehension. Some individuals may experience challenges in all these areas, including understanding spoken language [5].

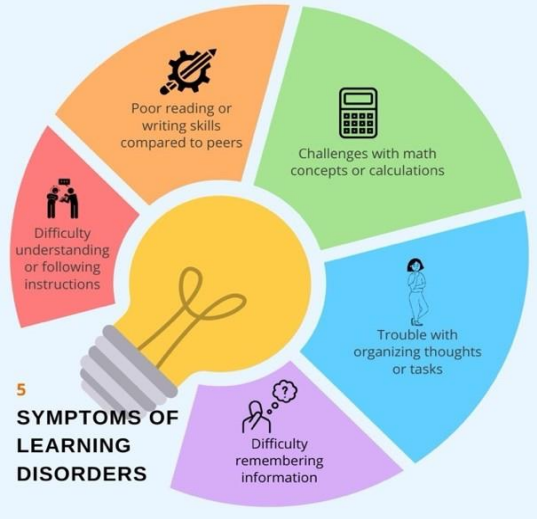


Fig 2. Symptoms of Learning Disability

LD encompasses a group of disorders that affect an individual's ability to process information, either through sight, sound, or connections between different brain regions. These difficulties manifest in various ways, including problems with verbal and written communication, coordination, self-control, and concentration. Such challenges often extend to academic performance and can hinder the ability to read, write, or solve mathematical problems effectively [6].

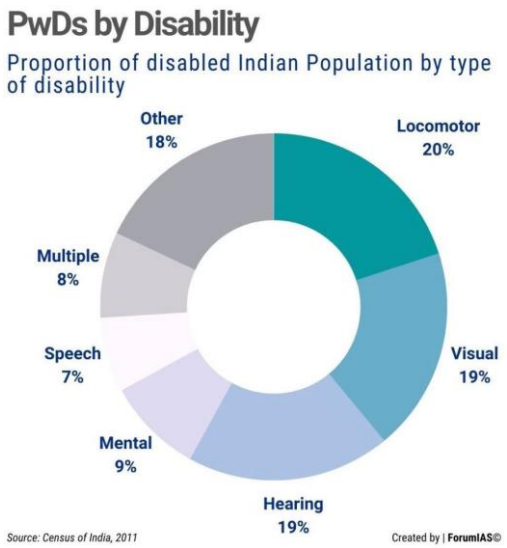


Fig 3. Proportion of disabled Indian Population by type of disability

In India 1.67% of the 0-19 population has a disability. 35.29% of all people living with disabilities are children. Other estimates say that India has 12 million children living with disabilities. Only 1% of children with disabilities have access to school [7].

A learning disability is a neurological disorder that affects the brain's ability to receive, process, store, and respond to information. It refers to difficulties in acquiring fundamental academic skills despite average or above- average intelligence. These skills are essential for academic achievement, career progression, and daily life. The term **"LD"** does not refer to a singular condition but is an umbrella term for multiple disorders [8].
In an academic setting, LDs are often categorized based on specific skill deficits. The most common learning disorders in school settings involve difficulties with reading, writing, or mathematics.

1. Learning Disabilities in Reading (Dyslexia)

Reading disabilities generally fall into two categories:

- **Basic reading difficulties** occur when an individual struggles to understand the relationship between sounds, letters, and words.
- **Reading comprehension difficulties** arise when a person has trouble understanding words, sentences, or entire paragraphs.

Common indicators of reading disabilities include:

- Difficulty recognizing letters and words.
- Trouble understanding word meanings and concepts.
- Slow reading speed and fluency.
- Limited vocabulary development.

2. Learning Disabilities in Math (Dyscalculia)

The severity of **math-related learning disabilities** varies based on an individual's cognitive strengths and weaknesses. Factors such as language difficulties, visual impairments, memory deficits, or organizational challenges can impact a child's ability to understand mathematical concepts.
Children with **dyscalculia** may struggle with:

- Memorizing and organizing numbers, mathematical symbols, and basic operations (e.g., 5+5=10).
- Counting patterns, such as skip counting by twos or fives.
- Telling time and understanding numerical relationships [9].

3. Learning Disabilities in Writing (Dysgraphia)

Writing-related learning disabilities can affect the **physical act of writing** or the ability to **organize and express thoughts on paper**.

- **Basic writing disorders** involve difficulty forming words and letters.
- **Expressive writing disabilities** affect the ability to structure sentences and organize ideas logically.

Symptoms of dysgraphia include:

- Poor handwriting consistency and legibility.
- Difficulty copying letters and words.
- Spelling inconsistencies.
- Struggles with sentence structure and organization [9].

4. Learning Disabilities in Motor Skills (Dyspraxia)

Motor skill impairments affect an individual's ability to perform coordinated movements. Dyspraxia impacts **fine motor skills** (e.g., holding a pencil, buttoning a shirt) and **gross motor skills** (e.g., running, jumping). These difficulties stem from challenges in brain-limb communication.
Children with dyspraxia may exhibit:

- Difficulty gripping writing tools or using scissors.
- Poor coordination in activities requiring balance and movement.
- Struggles with everyday tasks such as tying shoelaces or buttoning clothes [10].

5. Learning Disabilities in Language (Aphasia/Dysphasia)

Language-based learning disabilities affect the ability to comprehend or produce speech. Language processing is an **output function**, requiring individuals to organize their thoughts and articulate them effectively.

Symptoms include:

- Difficulty understanding spoken language.
- Problems with verbal fluency and storytelling.
- Struggles with following directions and grasping word meanings [11].

6. Attention Deficit Hyperactivity Disorder (ADHD)

Although **ADHD** is not classified as a learning disability, it significantly impacts a child's ability to learn. Children with ADHD may struggle with:

- Maintaining focus and attention.
- Sitting still for extended periods.

- Following instructions and completing assignments.
- Organizing tasks and\ staying on schedule [12].

7. Autism Spectrum Disorder (ASD) and Learning Disabilities

Developmental disorders such as **autism and Asperger's syndrome** can also contribute to learning challenges. Children on the **autism spectrum** may experience difficulties with:

- Making eye contact.
- Acquiring language and communication skills.
- Understanding body language and social cues.
- Engaging in social interactions [13].

Challenges in Transitioning to Adulthood

Research shows that many children with learning disabilities face difficulties transitioning into **independent living, employment, or higher education**. These challenges often stem from:

- Poor academic performance.
- Limited career aspirations.

- Misunderstanding of legal eligibility criteria for benefits and educational support.

Many individuals with disabilities wish to develop financial independence but fear losing government assistance, such as disability benefits and healthcare. This problem is further compounded by limited practical math skills, including knowledge of time, money management, and measurement systems. Additionally, since English is the most widely used language in education and employment, individuals with language-related disabilities may face additional barriers to effective communication [14].

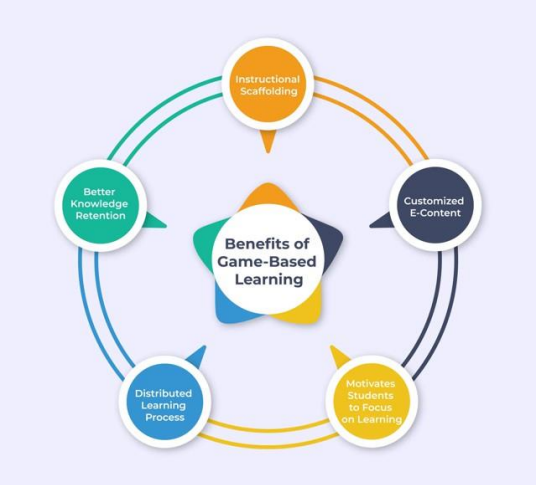


Fig 4 . Benefits of Game-Based Learning

Augmented Reality (AR) in learning disabilities, focusing on how **interactive gaming exercises** enhance engagement, retention, and comprehension. AR provides **immersive and adaptive learning experiences**, making abstract concepts more tangible for students with **dyslexia, dyscalculia, and ADHD**. By incorporating **gamified exercises**, AR fosters **active participation**, improves **memory recall**, and reduces distractions. Additionally, gesture- based interactions and **real-time feedback** create a more **inclusive and personalized learning environment**. This discussion will highlight how AR-based **educational games** can revolutionize **special education** and support learners with diverse needs.

2. REVIEW OF LITERATURE SURVEY

A mechanism to produce and deliver curriculum, track student involvement, and evaluate student achievement is made available to instructors through the Augmented Reality Cognitive Solution (ARCs). The use of ARCs and its associated tools improves student performance because they enable learners to interact with one another and share information constantly while also producing, updating, tagging, and rating content instantly. This creates engaging opportunities for student interaction. Additionally, synchronous and asynchronous communication is possible between students, teachers, and fellow students.

Literature reviews were done to proceed with the proposed project, and mentioned below are the briefs derived from the same:

1. Baig Muntajeeb Ali in *A Study of Application of Learning Management System (LMS) MOODLE in Communication of Information – A Literature Review* states that learner performance is enhanced by MOODLE and its tools. These tools make it possible for learners to communicate, collaborate, and share information 24/7 by creating, editing, tagging, and rating content instantaneously, thus making interaction among learners more engaging. Also, learners can communicate with their teachers as well as co-learners synchronously and asynchronously [15].
   MOODLE allows students to share knowledge and discuss their difficulties, so they can help each other via forums and chats. When lectures were uploaded, learners started exploring the site, participating in quizzes, and suggesting improvements

[16].

2. Jeffrey Branzburg in *How To: Use the Moodle Course Management System* describes how a Moodle course can be set up in one of three formats—weekly, topics, or social. Many modules can be implemented in Moodle, including Lessons, Quizzes, and Resources, which are three particularly useful modules [17]. The Lessons module provides structured learning content that students can navigate at their own pace. Questions at the end of each page in a lesson can be multiple-choice, true/false, short-answer, numerical, matching, or essay-based [18].
3. Carolyn Joseph in *Augmented Reality and Virtual Reality to Aid Students with Learning Disabilities: A Review* explains that augmented reality results from image processing techniques applied to different frames of video. Various techniques can be employed to make applications more interactive. Special frameworks need to be introduced to aid students with different disabilities accordingly [19]. Augmented reality technology also permits learning via remote collaboration, allowing students and instructors who are not in the same physical location to share a common virtual learning environment populated by virtual objects and learning materials and to interact within that setting [20].

Self-reflection and the transition from passive to active learning can both be accelerated with the aid of ARCs. Ultimately, it is the instructor's responsibility to use ARCs tools in a way that promotes interaction and engagement in the learning process, encouraging learners to have a more in-depth and fulfilling learning experience. Furthermore, these technologies provide pedagogical flexibility, linking to a range of teaching methodologies and supporting sound course design procedures. Coordinating asynchronous discussion boards, synchronous chats, and emails while running an online or e-learning course requires careful management. The function of the Augmented Reality Cognitive Solution is further expanded using emerging computer communication technologies like speech and streaming video.

3. INTEGRATING AUGMENTED REALITY INTO LEARNING ENVIRONMENTS

3.1 USING AUGMENTED REALITY IN LEARNING ENVIRONMENTS

Applications for augmented reality can enhance a core curriculum. It is possible to overlay text, images, video, and music over a student's actual surroundings. Textbooks, flashcards, and other reading materials for school may include embedded "markers" that, when scanned by an augmented reality device, provide the learner with additional information presented in a multimedia manner. Students may explore and study specifics of each major section of the event site through interactive computer- generated reconstructions of historical events. There are various applications that may be utilised in higher education. For instance, Construct3D, a Studiers tube system, enables students to study the arithmetic or geometry of mechanical engineering. Students engage in active learning as they learn how to use technology for learning. By enabling students to interact with a virtual representation of a molecule that appears in a camera picture that is positioned at a marker in their palm and see the spatial structure of a molecule, augmented reality can help students better comprehend chemistry. Additionally, it can help physiology students see the many systems of the human body in three dimensions. Additionally, augmented reality technology enables learning through remote collaboration, which enables instructors and students who are not physically present to share a similar virtual learning environment filled with digital resources and engage with one another inside it.

Primary School students might potentially benefit from this material. Since children are so young, they must observe in order to learn, but students also get knowledge from experiences. For instance, they may learn new information about astronomy, which is typically challenging for them to study. Using this equipment, kids can better grasp the solar system because they can see it in three dimensions. Even young children as young as six years old can understand it using this way. Additionally, students might use this resource to modify the images in their science books. The teacher would only need to press a button when the students moved the paper in order to use the same embedded "markers" to teach another part of the body. On the other hand, if they wanted to learn about bones or organs, they could also stick a piece of paper on their body that contained embedded "markers" about the bone or organ that was under the paper.

Develop the practical module's value for use in institutions of learning. To give the assistance needed to create a curriculum based on student needs that uses technology to bridge the gap between social issues for individuals with disabilities. Technology may be utilised to create creative educational programmes that aid in learning at a faster pace, with better memory, and with more comprehending capacity, since learning seems to be the major cause for worry.
The effectiveness of augmented reality for children with learning disabilities is demonstrated by the way it directly addresses the issues they encounter, such as their social anxiety and short attention spans, as well as their need for multimedia visuals and an environment that fosters better grasping and easy memorization skills. In this work, we run tests and discuss the findings from those tests.

3.2 AUGMENTED REALITY APPLICATIONS IN INDIA EDUCATION AT THE MOMENT

A software development company called Dimensions offers augmented reality services. Dimensions is a company that creates Augmented Reality-based teaching and learning tools for the 3D Web, popular virtual worlds like Second Life, and software platforms like OpenSim and Unity. They do not, however, have any augmented reality educational programmes for either typical pre- schoolers and elementary school students or children with learning difficulties listed on their official website. The same is true for other software companies that have only recently started their augmented reality endeavours. Some educationally forward-thinking Indian augmented reality applications are not based on the Android operating system. They may be used with PCs, laptops, etc. The pricey, infrequent educational augmented reality apps that run on the Android platform do not have a thorough emphasis that takes into account youngsters with unique needs, such as those who have learning difficulties.

The novel idea of augmented reality has just recently started to catch on in India, not only among the many different old and new software firms but also among the educational institutions offering specialised training on computer technology. The developers' major draws include the games, entertainment, languages, geophysical mapping, etc. It will take some time for it to attain the circularity level necessary to fully solve the problems associated with delivering education to children of all socioeconomic backgrounds. We have made an effort to incorporate this same comprehensiveness into our application.

3.3 CURRENT TEACHING METHODS IN INDIA FOR CHILDREN WITH LEARNING DISABIILITIES

A technology services company in the US (Alive Studio Co.) has employed augmented reality to develop storybooks for kindergarten students, teach fundamental numerical concepts to pre-schoolers, and other things [21]. However, there isn't yet a well-known augmented reality educational tool for kids with learning difficulties. A teacher-led educational content-based system called Edu Comp Smart class has been utilised in some schools. It has significantly improved learning results in Private Schools. It consists of digital curricular information shown onto projector displays. The majority of special education institutions continue to use paper-based instructional methods.

In certain schools, education for students with disabilities is now offered at a very low level. Most Indian schools disregard finance education as a pointless topic, yet as the nation and its citizens expand and become more powerful, the necessity for it increases. A key answer to a growing core learning disability problem would be to use augmented reality technology to create an android application on money management (financial literacy) specifically geared for persons with special needs (learning disabilities). Different learning difficulties are addressed through augmented reality, which benefits student learning. The idea of utilising augmented reality, 3D modelling, audio, video, and images aids in producing a more engaging project for the kids that is also very cost-effective.

3.4 HOW AN AUGMENTED REALITY COGNITIVE SOLUTION WORKS

This application provides the fundamental base for a learning environment built specifically for students with learning disabilities. Enrolment of students and allocation in appropriate modules concentrated on their impairment in any way. There shall be several assessment modules which are to be filled by the parents or students. Dynamic syllabus also generated. The questionnaire was created to classify children based on the severity and sequence of their disabilities.

We developed the Augmented Reality Cognitive Solution (ARCS) prototype to test the notion of augmented reality and analyse its influence, outcome, and limits. It makes the use of Google ARcore and Scene form According to Google, ARCore is an Augmented Reality platform. ARCore really assists the phone in sensing its surroundings and interacting with the outside world. ARCore relies heavily on three important principles: motion tracking, understanding the environment, and light estimation.

Sceneform, according to Google, is a 3D framework that allows developers to create ARCore apps without understanding about OpenGL. Sceneform has several capabilities such as checking for camera permission, altering 3D elements, and much more

In Addition to Google ARCore, we developed Augmented Reality Cognitive Solution (ARCS) prototype using Unity Game Engine to explore augmented reality's potential, influence, outcomes, and limitations. Unity, combined with AR Foundation, simplifies the development of AR applications across platforms. Unity Game Engine supports key AR functionalities such as motion tracking, environmental understanding, and light estimation, similar to ARCore. Its robust interface allows seamless integration of 3D objects, scene manipulation, and camera permissions, enabling developers to create immersive AR experiences without needing deep knowledge of graphics programming like OpenGL.

4. METHODOLOGY

4.1 Research Design

This study explores the **impact of Augmented Reality Cognitive Solution (ARCS)** on children with learning disabilities by implementing **personalized learning modules, interactive games, and assessments**. The methodology involves:

- **User Enrollment:** Each child is assigned a teacher or parent for guidance.
- **Initial Assessment:** A questionnaire identifies the child's disability.
- **Adaptive Learning Modules:** Based on assessment results, AR-based exercises and educational games are assigned.
- **Performance Tracking:** Continuous evaluation measures engagement, comprehension, and progress.

4.2 Application Workflow

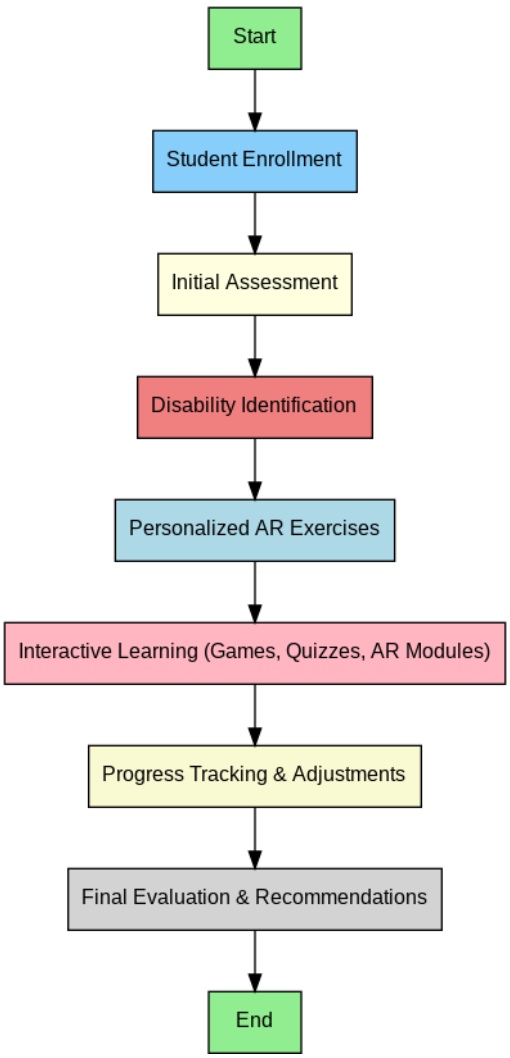
1. **Student Enrollment**
   - A teacher or parent registers the child in the system.
   - Basic details are recorded, including age and learning challenges.
2. **Assessment Phase**
   - The child, parent, or teacher attempts a **quiz-based assessment** to evaluate cognitive and learning abilities.

- The system analyzes responses and categorizes the child's disability.

3. **Personalized Learning Plan**
   - Based on assessment results, specific **AR-powered educational games** and **interactive exercises** are scheduled.
   - Modules cover areas such as **reading, writing, numeracy, memory, and motor skills**.
4. **Game-Based Learning & AR Exercises**
   - **Gamified activities** target key challenges like **dyslexia, dyscalculia, ADHD, and dyspraxia**.
   - The **AR interface provides real-time feedback** with voice assistance and gesture-based interaction.
5. **Performance Monitoring & Adaptive Learning**
   - Teachers and parents track progress through reports.
   - The **system adjusts exercises dynamically** based on progress and difficulty levels.
6. **FinalEvaluation & Recommendations**
   - The child's progress is assessed through quizzes and practical applications.
   - Reports suggest additional exercises or interventions based on learning outcomes.

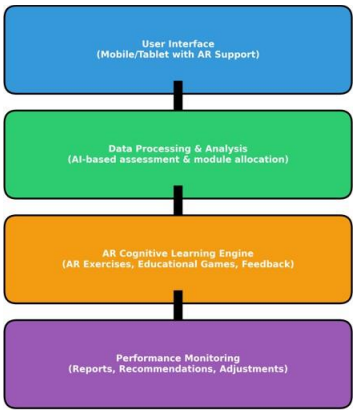
4.3 Flowchart of the Application

Below is a **flowchart** illustrating the methodology of the AR-based learning system:



4.4 System Architecture Diagram

This **diagram** illustrates the **architecture** of the AR-based learning system:



4.5 Expected Outcomes

- **Enhanced Engagement:** Increased student participation through gamification.
- **Improved Learning Retention:** Higher retention rates due to **interactive visualization**.
- **Personalized Education:** Customized exercises catering to **specific disabilities**.
- **Real-time Feedback:** Adaptive learning ensures **continuous improvement**.

5. RESULTS

AUGMENTED REALITY USER INTERFACE (AR – UI)

1. Vegetable Basket Exercise:

There are six veggies in a basket. Six buttons with the names of veggies on them. The corresponding vegetable emerges from the basket and assumes a specific position when pressing the corresponding button. Upon pressing the button once more, the corresponding vegetables return to the basket.

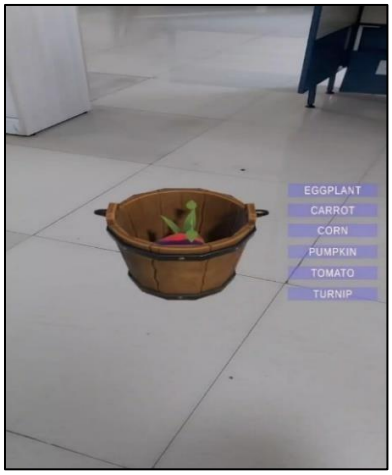


Fig 1. Snapshot of the Augmented reality Application

Fig 2. Vegetables taking positions on clicking the buttons.

2. Fruit Basket Exercise:

There are six fruits in a basket. Six buttons with the names of fruits on them. A button is pressed,
and the corresponding fruit emerges from the basket and assumes a specific position. When the button is pressed one more, the corresponding fruit returns to the basket.

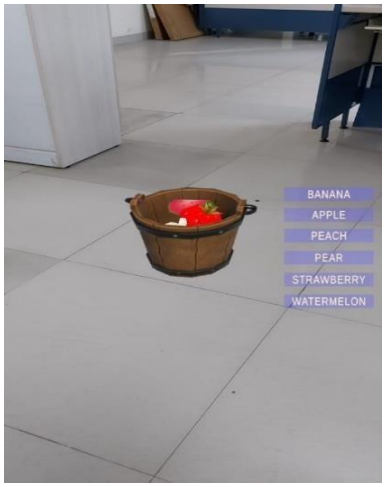


Fig 3. A basket with 6 fruits.

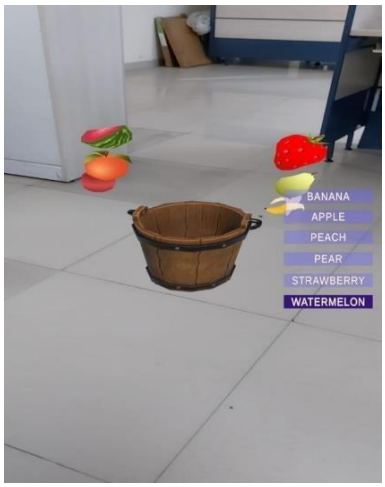


Fig 4. Fruits taking positions on clicking the buttons.

3. Addition Exercise

Two bowls and a few apples are present. When you drag an apple into the bowl, it collides, changing the bowl's colour and adding one to the counter below. The second bowl is the same.

The result is shown after adding the two counters, which is activated by clicking the button below.

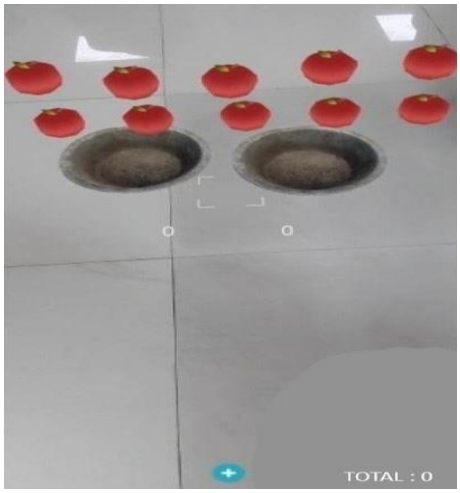


Fig 5. Addition of 0 and 0 is 0.

Fig. 6 Addition of 3 and 2 is 5.

6. ANALYSIS

To evaluate the effectiveness of our Augmented Reality-Based Educational Android Application for children with intellectual disabilities, we conducted an experimental study in a controlled classroom environment. The study focused on measuring improvements in engagement, learning retention, and ease of comprehension among students with varying learning disabilities.

6.1 Experiment Setup

The prototype application was tested with 30 students diagnosed with different types of learning disabilities, including dyslexia, dyscalculia, dysgraphia, dyspraxia, and ADHD. The participants were divided into two groups:

1. Control Group (Traditional Learning Methods): Used conventional learning tools such as textbooks, charts, and audio-based teaching aids.
2. Experimental Group (Augmented Reality- Based Learning): Used the AR- based application for interactive learning with 3D models, audio-visual cues, and gamified quizzes.

The study spanned four weeks, with periodic assessments conducted to analyze students' Progress in comprehension, recall, and problem-solving skills.

6.2 Key Findings

1. Improved Engagement Levels:
   - 85% of students in the experimental group demonstrated increased focus and interest compared to only 50% in the control group.
   - The interactive and immersive elements of AR learning significantly reduced distractions among children with ADHD [22].

Table. I Improved Engagement Levels:

Engagement Levels	**With ARCS**	**Without ARCS**
Student focus and interest	85% of students showed increased focus and interest	50% of students showed increased focus and interest
Effect on children with ADHD	Interactive AR elements reduced distractions	Higher distractions and less engagement

2. Enhanced Retention and Comprehension:
   - Students who learned through AR showed a 42% improvement in information retention after two weeks, whereas the control group only improved by 18%.
   - Children with dyslexia and dysgraphia particularly benefited from the visual and audio support provided by the AR application, improving

Their reading and writing accuracy.

Table. II Enhanced Retention and Comprehension:

Retention & Comprehension	**With ARCS**	**Without ARCS**
Information retention after two weeks	42% improvement	18% improvement
Effect on dyslexic & dysgraphic students	Improved reading and writing accuracy	Minimal improvement

3. Better Conceptual Understanding:
   - Students struggling with dyscalculia improved in basic arithmetic operations by 37% due to interactive number- based exercises and real-time visual demonstrations.
   - The application helped children associate symbols with actions, making abstract concepts easier to understand.

Table. III Better Conceptual Understanding

Conceptual Understanding	**With ARCS**	**Without ARCS**
Improvement in arithmetic (dyscalculia)	37% improvement in basic arithmetic	Lower improvement in arithmetic skills
Understanding of abstract concepts	Enhanced through interactive	Abstract concepts remained
	demonstrations	difficult to grasp

4. Emotional Response and User Experience:
   - 90% of students reported a positive emotional reaction to the AR interface, especially due to the engaging use of colors, animations, and voice- based guidance.
   - Students with dyspraxia found the gesture-based interaction more challenging, suggesting the need for customizable input methods [23].

Table. IV Emotional Response and User Experience

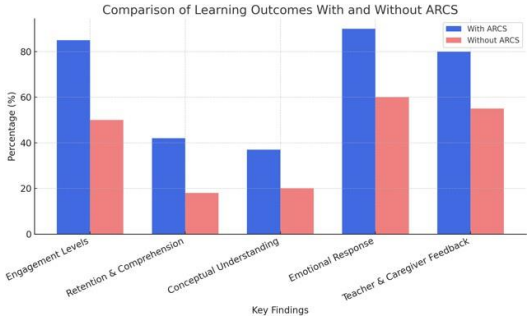
Emotional Response & UX	**With ARCS**	**Without ARCS**
Student emotional reaction	90% reported a positive response	Lower engagement and motivation
Interaction challenges	Gesture- based interaction was difficult for students with dyspraxia	No gesture- based interaction, but traditional methods still had accessibility issues

5. Teacher and Caregiver Feedback:
   - 80% of educators found the AR tool more effective than traditional methods for explaining abstract concepts [24].
   - Caregivers observed a noticeable improvement in confidence and self-paced learning among children using the app [25].

Table. V Teacher and Caregiver Feedback

Teacher & Caregiver Feedback	**With ARCS**	**Without ARCS**
Effectivenes s in teaching abstract concepts	80% of educators found ARCS more effective	Lower effectivenes s
Confidence and self-paced learning in children	Caregivers observed noticeable improvemen t	No significant change

"Impact of ARCS on Learning Outcomes: A Comparative Analysis



Analysis Summary:

- **Engagement:** 85% focus with ARCS vs. 50% without; reduced ADHD distractions.
- **Retention:** 42% improvement with ARCS vs. 18% without; better support for dyslexia/dysgraphia.
- **Conceptual Understanding:** 37% arithmetic improvement with ARCS; easier grasp of abstract concepts.
- **Emotional Response:** 90% positive reaction; dyspraxia users need customizable input.
- **Teacher & Caregiver Feedback:** 80% educators preferred ARCS; improved confidence & self-paced learning

7. CONCLUSION

AR-based tools like ARCS represent a promising frontier for enhancing the education of children with intellectual disabilities. By offering an interactive and sensory-rich learning environment, these tools help children overcome challenges associated with traditional teaching methods. AR enables a more personalized learning experience, helping children grasp difficult concepts by interacting with virtual objects in the real world.

The success of ARCS lies in its ability to engage children with fun and educational exercises that are tailored to their specific needs. As technology continues to evolve, tools like ARCS can play an increasingly critical role in making education more accessible and effective for children with learning disabilities. Expanding the scope and depth of such applications can contribute to improving educational outcomes for children across the globe, ensuring that no child is left behind due to learning challenges

8. LIMITATIONS AND FUTURE SCOPE

Although we have gone a long way in our efforts to provide a complete approach to educating children in India using augmented reality, the concept is fresh. As a result, we have a long road ahead of us to try to polish our application to a globally acceptable quality standard. For the time being, ARCS is a basic toolset restricted to letters, numbers, and shapes.

There are several software and hardware components that may be added to our programme in the future. We can add letters to a language module, numbers to a mathematics module, and so on.

Project ARCS aspires to break free from the constraints of rigidity in the future. In the future, we hope to make the course more adaptable and interesting. We may incorporate games and quizzes, 3D films, stories, evaluation tools, augmented reality locations, and so on in the programme.
In the future, we intend to make ARCS one of the greatest options for educating kids with learning difficulties using augmented reality. To that end, we will gather additional sample data and undertake a preliminary study on various social, mental, and behavioural characteristics that need to be incorporated into our algorithms so that ARCS is closer to classroom norms for all types of children.

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