

# Communicative Affordances of Virtual Reality for Special Education: A Systematic Review

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## ABSTRACT:

Virtual reality is an interactive technology that holds the potential to revolutionize the education system. This potential is promising in the case of Special education. Education for children with disabilities has always been a limited approach. However, virtual reality has altered the dimensions. The study looks into the extent of VR in the realm of Special Education through the lens of literature. The research employed a PRISMA-based Systematic Literature Review for the meta-analysis of thirty articles identified during the 2021-2024 period. The Communication Affordance theory allows us to identify and analyze the themes of Immersion, multisensory interaction, and Metaverse as tools of education, as evidenced by the literature. The study suggests that virtual reality is an effective source of education through activity-based learning and enhances the physical, social and cognitive capabilities of students with disabilities.

## KEY WORDS:

Special Education, Virtual Reality, Systematic Literature Review, Communication Affordance

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## Cite this Article:

Rashid, M., Zeb, J., & Ansari, N. A. (2024). Communicative Affordances of Virtual Reality for Special Education: A Systematic Review. *The Regional Tribune*, 3(1), 68–82.  
<https://doi.org/10.63062/trt/V24.021>

## Introduction Special Education

Special education is a multifaceted service. Individuals identified with disorders like autism, deafness, blindness, mental delays, hearing impairments, orthopaedic impairment, specific learning abilities, linguistic disabilities and many more are to be provided with special education services in diverse settings catering to their needs. Teachers here have an important role as they are the deciders of information their students might receive. However, the more it relies on individuals, the more it is not trustable. Science and technology are widely being explored in special education. To articulate the methods of special education, it is necessary to identify how individuals react to interactions (Rumrill Jr et al., 2020). The field of special education brings innovative interventions to enhance the performance of individuals with disabilities. They learn to overcome their individual difficulties; however, the system is still inadequate for the learning of individuals with disabilities. There is a dire need to reconceptualize special education to develop all-inclusive, personalised and customizable educational attributes (Andrews et al., 2000). Historically, students with disabilities were given space in separate classrooms. However, the correct education was not provided. However, today, special education classrooms are being transformed into an all-inclusive learning system. Education is developing from isolation to inclusion, and technology is foreplay in the scenario. The 21st century has a retrospective view of paradigms of special education. Reforms on the social dimensions of the issue have been made. The idea of inclusive schooling is appealing but difficult to execute. It encompasses the diversity

of education and deals with the societal demands on education. Technology is the conclusive factor in transforming special education systems (Winzer, [2000](#)).

## VR, AR and Metaverse

Virtual reality is a technology that offers a rich sensory experience. It creates a sense of realism and presence in the world. VR is a three-dimensional interactive technology that breaks the threshold of boundary and framing. The defining attribute of VR is the real-time interactivity in a non-real world. It is a threefold merger of Immersion, interaction and Imagination. Starting from the earliest displays of sensorama to head-mounted gears in 2024, virtual reality has managed to develop into a realistic experience (Burdea & Coiffet, [2003](#)). Virtual reality technology has given rise to synthetic environments. The synthetic environments are the 3D scenes through which users can navigate and interact with each other. The ability to move around and explore the features of a virtual computer-generated scene and interact, hold and move around objects through the virtual world makes it a realistic space. Navigation and interaction are possible through real-time graphics and stereoscopic images. The VR display also fosters properties like immersion and presence as its core features. The interactivity feature enhances immersion and, in turn, focus and attention to detail (Vince, [2004](#)). Augmented reality is an emergent branch of virtual reality. It is the concept through which one can immerse oneself in the virtual and real worlds. The simulated virtual environment has today become a collective space for artificial reality, augmented reality, and cyberspace. The meaning of VR is generated through audience interpretation. For virtual reality, the phenomenon of iteration is more important than technology; in the context of human processes, whether cognitive, social, physical or intellectual, technology is actually a tool for expediting action. Technology is only invested in the ideological orientation (Bhugaonkar et al., [2022](#)).

Augmented reality is the view of the real world enhanced by virtual objects. Hence, it can be termed as a collection of Virtual and Augmented Reality. It eases user experience by augmenting information into his real-world surroundings. AR interfaces are tangible and reduce lingual barriers (Carmigniani & Furht, [2011](#)). AR uses different methods for computer vision. They are usually projected through head-mounted displays, hand-held displays and spatial displays. It has, hence, become a platform of commercial attraction. AR and VR games have come into play (Furht, [2011](#)). Metaverse is a post-reality universe that has a consistent environment embedded with multiple users merging physical reality and digital virtuality. Metaverse is a new paradigm in the wave of immersive technologies. VR is a digitally created environment, AR is an augmented environment, and MR is where the physical environment is iterated upon digital data. Metaverse is a fusion of all these. It is a multisensory virtual environment with digital objects and people. It gives the fidelity of XR displays. Users activate their digital bodies- avatars- and move around and interact with other digital bodies. It can be called Web 3.0. Users meet and socialize without any embodied restrictions. However, this can lead to physical health issues, privacy concerns and data theft, motion sickness, fatigue and irrelevant violent triggers in the space (Mystakidis, [2022](#)). Problem-solving is the basic skill taught to primary school students, whereas immersive technology has the feature of presenting abstract artefacts into tangible objects. The feature is used to improve students' problem-solving skills. Learning attitudes and interactions with learning materials have a great effect on educating students' problem-solving skills (Herrero & Lorenzo, [2020](#)).

## VR and Special Education

Virtual reality is categorized by the immersion offered to users. By manipulating the environment in digital space, users are immersed in a perceived reality. The VR equipment senses and tracks the users' navigations and converts the imagery accordingly. Virtual reality has great potential for education of students with physical disabilities. Students with disabilities can openly participate in virtual learning setups. Students are allowed to move around either physically or with wheelchairs in the environment. They can touch, move and manipulate artifacts and interact within a virtual irrespective of the physical limitations they feel in the real world (Raskind et al., [2005](#)). Virtual learning environments target both cognitive and behavioural factors. In VR, users have control over the learning process. The

experts have been working since the 1990s on developing VR as an effective tool for education. The VR environment focuses on the notion of improved structures and simulations to increase the sense of presence and realism. The individuals with disabilities such as sensory impairments, cognitive disabilities, and autism. Attention deficit and behavioral disorder are all that are discussed in the context of virtual reality. The VR environments are customized to be designed according to the cognitive, physical, and navigation abilities of students. The environment is instructional and interactive. The children with sensory impairments can use sound and smell features for navigation. Hence, VR environments maximize learning through interactive educational activities. The sensory inputs and outputs can be changed as per users' needs. Haptic devices, joysticks, gloves, and pens are also an aid. Visual impairments can be catered to through sound. Children can learn to search, move, localize, design, and develop orientation skills. Sounds enhance motivation, attention and focus. Children with autism learn to manage through cognitive tasks such as contextualization, impulse, and behaviour controls. They can learn social skills through VR imitation play. Students with attention deficits and hyperactivity can learn to control their behaviour through different task-based activities on VR (Jefferies, 2009).

Problem-solving skills are the core issue with students with disabilities. They lack social competency and problem resolution. VR with a realistic format can be used to facilitate students with disability to work on their problem-solving skills and apply them to the real world (Wu et al., 2021). Assessment tools have been developed to make virtual reality an accessible medium of education. VR measures the children's performance by changing the complexity of tasks. Functional learning is a preferred concept for special education over technology. But technology has a foreplay in special education. VR projects have been designed for social and communication skill learning, science experimentation and simulations, attention, safety skills and anxiety-controlling tasks to improve the standards of special education through VR. A review of AR, VR, and MR used for educating social interaction skills in children with disabilities suggests statistical gains for students if the technological intervention is increased. The immersive media enhanced ASD children's emotions; children are able to maintain their attention and learn to give appropriate responses to actions. They can understand an event with a proper response. Improvements can be gathered during fixation time and social orientations by using avatars as peers. The engagement level is sustained for a longer time period and reciprocates interactions with the digital avatars of peers (Mosher et al., 2022). However, immersive media is a field that requires educators to train students as well.

As VR increase motivation, it must be included in the education sector as well. To immerse the technology into education, training and knowledge of diverse fields are required. Immersive learning is a tool of education, and implementation of this application is only possible with proper training for both students and teachers. The acquisition of knowledge from VR is effective and needs exploration (Ali, 2022). The use of spatial media and VR for special education research has been a significant research era in the 21<sup>st</sup> century. Researchers such as North et al., (1998) have been working on VR technology for treating phobias, Inman et al., (1997) on manipulative wheelchair for children, Riess and Weghorst (1995) on Parkinson's disease, Strickland (1997) in autism, Wann et al. (1997) on attention skills and Standen & Brown (2005) on using VR to rehabilitate children with intellectual disabilities. Empirical systematic and statical research has been carried out to explore its scope.

The current study is also focused on identifying the communication affordance of VR in special education. The present study aims to look into the attributes and features of the immersive technology that it offers for education and learning process. The study also stands to identify the useability of VR immersive technology for educating children with special needs.

## Research Question

The questions addressed are:

1. RQ1: What types of communicative affordances (e.g., immersion, multisensory interaction, interactivity) are offered by VR technologies used in special education interventions, as reported in the reviewed studies?

2. RQ2: How do the identified VR affordances (from RQ1) contribute to communication and learning processes for students with special needs, as evidenced in the findings of the systematic literature review?

## Methodology

The current study employs a Systematic Literature Review to investigate the use and affordance of metaverse in special education. SLR observed requirements identified in the preferred reporting items for systematic reviews and meta-analysis PRISMA statement and The Cochrane method handbook (Moher et al., 2009). A systematic literature review is a scientific way of identifying and forming evidence to answer a research question. The evidence generated is, hence, transparent and reproducible. The SLR reviews the existing published literature on the subject, hence appraising the quality of evidence. SLR reduces bias and generates transparency in research. The literature is identified and selected via systematic means to enhance the quality of the research. SLR is a preferred method of Meta-Analysis as it provides a structured approach to answering research questions. Such systematic reviews and meta-analyses aid in developing and detailing evidence on the efficacy of research, leading to reliability and accuracy. It is an attempt to collect and collage empirical evidence eligible to the posed research question. The studies and reviews are validated, and systematic characteristics are identified. Meta-Analysis summarizes the results of selected studies (Kitchenham et al., 2009; Lame, 2019; Nagy, 2022). PRISMA statement is a 27-item checklist that is designed to improve the reporting of evidence via systematic review and meta-analysis. Forming a SLR identifies the purpose, literature selection and extraction of results. PRISMA helps to develop trustworthy findings and methods to analyze literature (Han, 2023; Liberati et al., 2009; Moher et al., 2010).

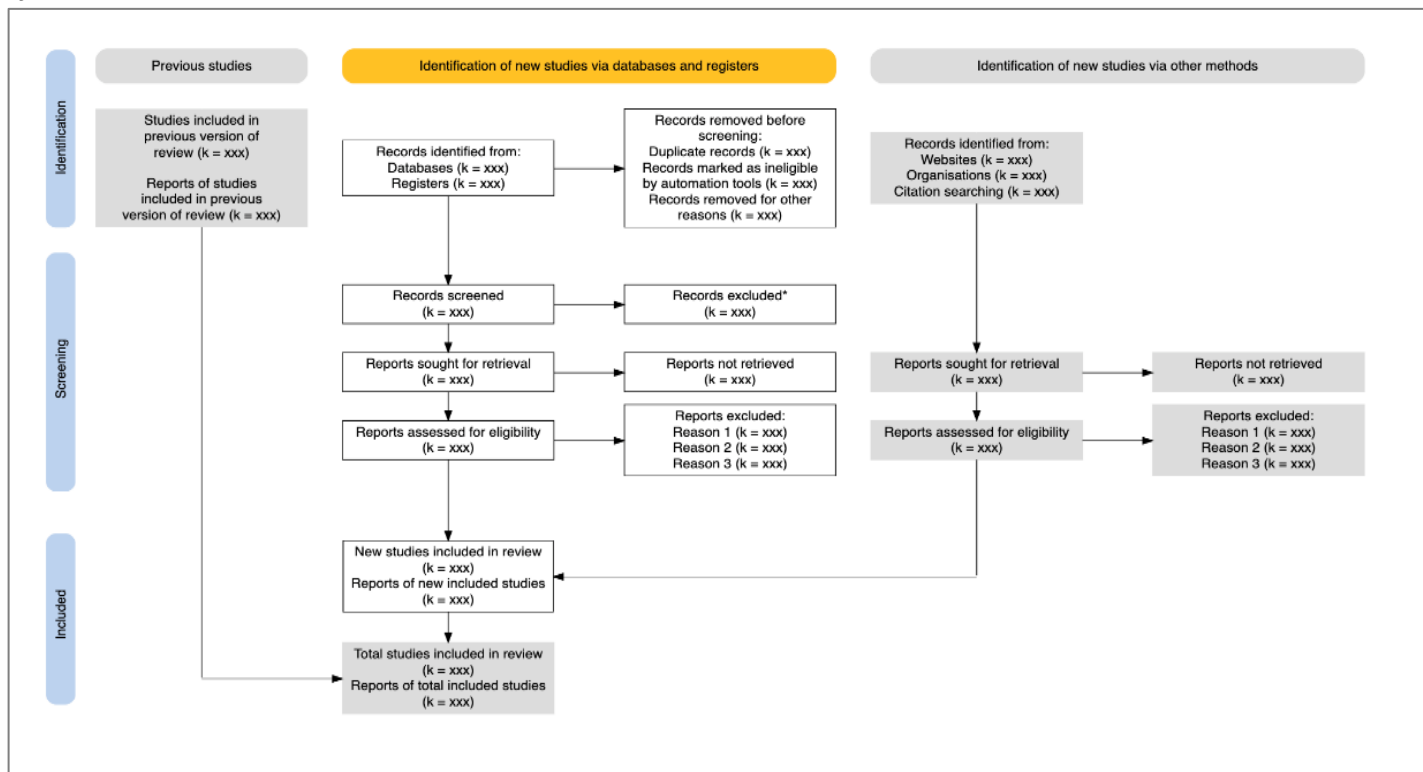
The current study uses the Prisma statement for a systemic literature review to identify the usefulness and affordances of metaverse in the education of children with special abilities. The starting point was to recognize the research subject for SLR. The research topic determined for the current SLR is Exploring the Communication Affordance of VR for Special Education. The 2nd phase included working on designing a search plan for identifying relevant and pertinent studies. The research was carried out across internet databases, such as Google Scholar, the Web of Science, and Scopus. Along with this, the research also incorporated books, reports, conference proceedings and journals.

The keywords are identified in the continued search. The keywords relevant to the subject of communication for Special children via metaverse VR included Metaverse and Special Education, Communication Affordance in Metaverse for special children, Virtual Reality as a platform of learning for special children and VR for special education. The studies were identified and scrutinized according to the applicability of the present research subject and criteria for inclusion. The criteria are pre-defined as research studies of the relevant subject written and published during the time period of 2021 - 2023. A total of 80 studies were identified. The research that failed to meet the designed criteria was not subjected to peer review, and those that were inaccessible were excluded from the sample. A total of 30 research is selected after the scrutiny.

Furthermore, an established data extraction is made to cater to details of researcher, publisher, publication year, research methodology, sample, findings, and limitations as the keys for extracting data process. The scientific Validity of research was evaluated through techniques from the Joanna Briggs Institute Critical Appraisal Checklist for qualitative studies and the Cochrane Risk of Bias tool for randomized controlled trials. GRADE (Grading of Recommendation Assessment, Development and Evaluation) was used to assess the quality of evidence.

The SLRs finding have been listed in an organized way and the reviews are conducted for its affordance for people, organizations and society. The constraints and recommendations are also discussed. SLR provided an objective lens on the evidence and studied the usefulness of metaverse, virtual reality for special education generating a new societal environment for education. It recognized the potential benefits and drawbacks that the mentioned technology carries for society.

**Figure 1**  
Systematic literature review PRISMA framework



**Table 1**  
Data for SLR

Sample Size details				
S. No	Article Title	Published in	Year	Relevancy
1.	Augmented reality for learning in special education: A systematic literature review	Taylor & Francis	2021	Multisensory Interactivity
2.	V-social: a cloud-based system for social virtual reality learning environment applications in special education	Springer	2021	Immersion
3.	A Review of Virtual Reality Intervention Research for Students with Disabilities in K–12 Settings	Sage	2022	Immersion in special education
4.	A Networked Social Virtual Reality Learning Environment Platform for Special Education	Local Computer Networks LCN	2021	Multisensory Interactivity
5.	Mindfulness Strategies for Metacognitive Skills Training in Special Education: The Role of Virtual Reality	Technium Social Sciences Journal	(2022).	Multisensory Interactivity
6.	Virtual Reality-Based Social Skills Training for Children With Autism Spectrum Disorder	Sage	2022	Mult sense Interactivity
7.	Applications of Virtual Reality for Autism Inclusion. A review	Retos	2022	Multisensory Interactivity
8.	Virtual reality for children with special needs	Conference Paper	2022	Immersion

Sample Size details				
S. No	Article Title	Published in	Year	Relevancy
9.	Literature Review on The Use of Virtual Reality in Special Education: Current Situation and Opportunities	International journal of contemporary approaches in Education	2022	A tool of education
10.	Virtual reality and augmented reality as strategies for teaching social skills to individuals with intellectual disability: A systematic review	Sage	2023	Immersion
11.	Using Virtual Reality (VR) in Teaching Students with Dyslexia	Journal of Emerging Technology in Learning	2021	Multisensory Interactivity
12.	Effects of virtual reality role-play on social communication skills of children with AD/HD	Conference Paper	2021	Multisensory interactivity
13.	Virtual reality is a pragmatic technique for multi-sensory storytelling to improve the social communication of children with special needs	ICTACT	2021	Multisensory interactivity
14.	AI and VR Enabled Modern LMS for Students with Special Needs	Journal of Foreign Language Education and Technology	2023	A tool of education
15.	Metaverse in Education: Contributors, Cooperations, and Research Themes	Conference Paper	2023	Tool of Education
16.	Exploring Multi-Sensory Interaction to Enhance Children's Learning Experience	Conference Paper	2021	Multisensory Interactivity
17.	Educational Technology Based on Virtual and Augmented Reality for Students With Learning Disabilities: Specific Projects and Applications	IGI Global	(2022).	Immersion
18.	Suggestions for Special Education Teachers to Practice Spherical Image-based Virtual Reality Instruction in Classrooms: A Case Study	Case Study	2021	Multisensory Interaction
19.	The metaverse in education: Definition, framework, features, potential applications, challenges, and future research topics	Frontiers in Psychology	2022	Tool in education
20.	Serious Game for VR Road Crossing in Special Needs Education	Electronic	2022	Tool of Education
21.	Inclusive educational effectiveness through Metaverse for disabled students and policy suggestions	Journal of Intelligence and Information Systems	2023	Tool of Education
22.	Metaverse in education for students with disabilities	Conference Paper	2023	Tool of Educations
23.	Art gamification (and digital/media arts) for special school: New thinking shifts for inclusive metaverse's engineering	Metaverse	2023	Tool of Education
24.	Inclusive metaverse in media arts education: New innovative methodological proposal for inclusive school	Metaverse	2023	Tool of Education



Sample Size details				
S. No	Article Title	Published in	Year	Relevancy
25.	STEAM Project Exhibition in the Metaverse for Deaf High School Students' Affective Empowerment: The Power of Student Museum Exhibitions in Social Virtual Reality	Conference Paper	2023	Tool of Education
26.	Neuro-Linguistic Programming, Positive Psychology & VR in Special Education	Scientific Electronic Archives	2022	Immersion
27.	A Literature Review on VR-implemented Studies in General and Special Education	Journal of Digital Contents Society	2022	Immersion
28.	VR Gaming for Meta-Skills Training in Special Education: The Role of Metacognition, Motivations, and Emotional Intelligence	Education Sciences	2023	Immersion
29.	Virtual Reality in Special Education: An Application Review	Journal of Information System Applied Research	2023	Immersion
30.	Introducing Immersive Learning into Special Education Settings: A Comparative Review of Two Studies	Springer	2021	Immersion

The extracted themes deeply examine the use of Virtual reality for special education. The ideas extracted implicitly explain the use of VR to enhance the education system for special children.

## Findings and Discussion

### Findings

#### Immersion

Immersion means being plunged into something. Immersion is a property of technology that indulges individuals into an environment generating psychological sense of presence (Agrawal et al., 2019). Immersion in education is a concept being long explored. The current study identified immersion as a core theme when explored under the subject of using VR in special education.

Immersion has been identified as an important aspect of VR for special education as it motivates and improves their focus as compared to the traditional methods of education. The consideration of VR in special education identifies how virtual learning environments offer immersion in special education. The platform enhances the network speed and fidelity to generate a more immersive experience for students as well as instructors. Wearable immersive technologies provide multiple learning modules that allow students to engage with the content in an immersive manner. The VR generalizes the lessons to the real world and allows students to make use of learned skills in the real world effectively. Also, the application provided to students in Virtual learning platforms fosters ease of use and consistency in learning (Nuguri et al., 2021). Another study shows that VR can greatly support special education and learning for students. VR can support the educational needs of students with disabilities. VR interventions increase engagement and academic performance as well as improve skill development in children with disabilities. Also, the skills learned through VR can be learned and effectively applied and transferred to real-life situations (Carreon et al., 2022).

An experimental study conducted on a classroom prototype for students with developmental disabilities states that VR classrooms empower students with disabilities. The cognitive and motor response could be enhanced due to immersion. VR has a transformative potential in shaping special education classrooms. There is a need to enhance VR environments in terms of immersion and visualization as they play a beneficial role in educating students with special needs (Bosse et al., 2022). Children with autism spectrum and language disorders can benefit

from VR learning. The immersive virtual environments develop their social skills. The use of VR and AR provides immersive classrooms for education and learning and can ease anxiety, resulting in enhanced learning of social skills related to intellectual disorders (Montoya-Rodríguez et al., 2023). VR provides a personalized learning format for children with dyslexia. Teachers can provide them with a more immersive environment that caters to their interests and improves their learning. The immersive environment reassures student participation by making the learning entertaining (Cano et al., 2022). Studies have been conducted on different aspects of VR technology and its use in special education. Neurolinguistic programming in VR aids in special education. It reduces the bias and promotes involvement. The use of Avatars in Metaverse and VR detaches people from the real world and natural thinking manner, supports their self-image and cultivates positivity in them. VR gaming technology is also being employed to educate special children. It has been found that VR gaming enhances children's search strategy and processing. Children with learning disabilities grasp onto motor coordination, children with dyslexia develop language skills, and children with dyscalculia show improved learning and visualization skills (Drigas et al., 2022; Ip & Li, 2021; Mitsea et al., 2023). Hence, it can be concluded that virtual reality provides a platform for learning for people with cognitive, intellectual, or motor disabilities. Concerns lie in technical defects such as coordination, difficulty accepting technology, and delayed response.

### Multi-sensory Interactivity

VR technology is medium that enhances users' engagement by targeting the multi-sensory stimuli. The technology caters to multiple senses of individual enhancing their interaction and involvement. The sense of touch, sight and sound cater to the different varying abilities of students with special needs. It caters to their diverse learning styles and intellectual capabilities.

The first article focuses on the use of augmented reality for the education of children with special needs. The technology blends the real and virtual worlds, allowing students to interact with educational content in a more interactive manner. Auditory, visual and tactile stimuli come together to cater to the diverse learning styles for special education. The multisensory experience hence enhances the social, navigation and physical skills of students with special needs. It enhances their comfort and confidence as well as their engagement with their fellow students (Yenioglu et al., 2023). A virtual reality learning environment was tested in research, indicating that VR offers a more realistic and immersive experience for special education if multiple senses are involved. The multisensory engagement through Avatars allows students to interact with peers and teachers visually and audibly in real time. The ability to roam around in an environment improves hand technical skills and hence contributes to learning more as compared to a traditional learning environment (Oruche et al., 2021).

Ke et al. (2022) explored Virtual Reality technology for special education of children with autism spectrum disorder and identified that multi-sensory engagement helps children with ASD to enhance interaction via role play in a VR environment. Interactive VR stimulates the visual and auditory senses to respond to virtual stimuli. It develops their skills of interaction and negotiation. VR also enhances the metacognitive skills of children with special needs. The research on skill training in children through VR studied students with ADHD, Autism, Tourette syndrome, dyslexia, giftedness, and anxiety and found that VR learning environments improve their attention and inhibition controls, regulate their emotions, develop self-management skills and control of aggressive behaviours, and improve observation and self-regulation skills. Hence, experiential learning through VR allows children with special abilities to enhance interactivity with the environment (Bravou et al., 2022; Mitsea et al., 2022).

Maskati et al. (2021) studied the application of VR in special education for dyslexia, suggesting that VR can enhance the learning process if multiple senses are stimulated at the same time in an interactive, immersive environment. The interviews with education specialists and a virtual application experiment on dyslexia students identified that a multisensory environment builds up the interests of students. They eagerly interact, remain focused and learn effectively. Teachers who are education specialists, as well as students who require special education,



should adopt VR technology to enhance the students' performances. Studies show that special education teachers must be equipped and experienced with VR technology. VR motivates students' sensory presence and provides them with real-life training (Cheng, [2021](#)).

A study analyzed Virtual reality role play for special education suggests that VR engage multiple senses, generating an interactive environment and hence making the learning more engaging and memorable. Children learn to navigate through virtual environments through interaction and communication and tend to stay focused. However, avatars sometimes also become a source of disturbance for them (Bote, [2021](#)). Virtual reality, which is immersed in artificial intelligence, promotes communication skills in children. A study on ASD children used the VR feature of a Multisensory environment to target their engagement with storytelling. The personalized storytelling in VR, customizable as per individual preference, fostered children's responses and engagement, hence enhancing their social interaction skills. The VR storytelling caters to their shortfalls and aids children in a normal and real-time environment. A multisensory environment stimulates the senses and facilitates deeper understanding (Cosentino, [2021](#); Prabakar et al., [2021](#)).

It is observed from the literature analyses that the theme of Multisensory interaction is prevalent in literature as an engaging quality for special education.

### Metaverse as a Tool of Education

Metaverse is a world where augmented and virtual reality interact to generate vibrant avatars to link people. The technology has potential modules for turning into a transformative tool of education for special children (Mustafa, [2022](#)). The literature reviewed has explicitly supported this theme as metaverse has applications in special education.

The three-dimensional space of metaverse studied for the Steam project identifies the role of the meta environment for the education of deaf students. The platform provides a social ripple effect for students and hence has great affordances for the education of children with certain physical disabilities (Mystakidis et al., [2023](#)). The virtual reality applications in special education are vast and are to be experimented. One of the important tasks of educating special children is to make them able to live and work independently in society. VR platforms such as Metaverse improve children's communication skills as they interact through avatars, which in turn reduces their social anxiety. VR-supported learning enables students to embody learning. The environment provides them with material tools to cater to their senses. They feel more encouraged to participate and learn (Demir, [2022](#)). Literature provided learning models for educating individuals with disabilities. Special education educates children as per their particular disparities. Metaverse, when fused with AI, becomes a platform of interactive and engaging learning. It can provide an outdoor multiple-activity experience to help them relate to the situation realistically. It also helps students interact with peers, and when AI is merged with it, Meta provides a personalized learning experience. The AI VR recognize the different natures of students and provides activities that cater to their specific learnings. Also, it makes distant learning an enjoyable experience (Sharma & Dash, [2023](#)).

Metaverse, as an interactive, immersive platform, offers mobility, communication and distant learning and is a star feature of training for students who need special education. Metaverse in education helps students as well as teachers. Also, VR can make special education accessible for students with disabilities in remote areas and hence offer more inclusive and diverse learning (Kudry et al., [2023](#)). Edu-Metaverse is a term to define the role of Metaverse in education. Metaverse caters to physical education, problem-based learning, VR-supported art creation, and immersive language learning, hence multiple stages of education for special children. However, technology can offer issues such as privacy, real-virtual imbalance, and lack of teaching staff. Metaverse promotes motor learning through football and tennis games (Muhammad & Musa, 2024). It also provides emotional satisfaction to children. It also improves the understanding and application of learned capabilities in real scenarios (Chen et al., [2023](#)). VR and

metaverse applications are being used to educate special children on specific activities. People with ASD suffer from lacking communication and social skills, so meta has been studied to make them learn daily routine tasks to make them independent. Meta is used to teach ASD children road crossing with minimum life risk. The game design method in VR trains students with special needs and necessary life skills, compelling their gestures and movements to increase interactions ([Tan et al., 2022](#)).

Song ([2023](#)) proposes that Metaverse offers inclusive education for students with disabilities. Metaverse can change the pattern of education and learning for special children. Meta-Edu for disabled students helps students to overcome the social barriers of interaction. Gamifying education in VR is a source of learning for special children. Metaverse engineering allows students to engage and interact through virtual art. Special education can be integrated into an immersive environment, opening ways for diverse subjects to learn according to students' liking and comfort (Bernaschina, [2023a](#), [2023b](#)). It is evident in the literature that the metaverse is an efficient tool for education. Strong engineering can transform meta into a new method of special education and learning.

## Discussion

In the following section, an extensive literature review is done to identify the communication affordance of Virtual Reality for special education. The analysis reviewed the technology use in special education with various themes. The analyses explored Virtual Reality as a multisensory interaction tool, VR immersion and Metaverse as the tool of Special education. A systematic literature review has been conducted as per the requirements of Preferred Reporting Items for Systematic Review and Meta-Analysis.

Immersive technology has vast applications in education, entertainment, gaming, marketing, and social interaction. According to the analysis, virtual reality is an emerging tool that is being increasingly researched in the Edu-Meta field. Edu-Meta is the use of Virtual reality tools, including Metaverse, to develop education and learning. The analysis reviewed the diverse ways VR is used for special education. The analysis also identifies the limitations and considerations of virtual reality as a new mode of education. VR is an immersive medium of education, enhancing children's engagement, multiple senses, and interactive learning, which collectively work for students to cope with diverse physical, cognitive, and intellectual disabilities and learn in an inclusive, immersive environment.

The research worked on the objective of identifying communication affordances of VR in special education. The themes identified are the communication attributes that VR offers for special education. The systematic review of the literature identified immersion as the basic affordance of VR. Immersion of the technology is the notion that excites researchers to explore its subdomains, one of which is special education. Another affordance is multiple senses interaction. VR offers a multisensory experience, enhancing the interaction of individuals with the environment without any social or peer pressure. Another affordance identified from the literature is the use of the Metaverse as a tool of education. VR, when turned into a metaverse, generates a world that offers interaction with the classroom peers but in the form of avatars. The diverse affordances have a variety of applications associated with them. Furthermore, the study aimed to identify the utilization of VR communications affordances for special education development. The results analysed from the themes suggest a variety application for the variety of disabilities. For special education, disability varies, and so does the instructor, educator and mode of education. However, VR is a transformable medium that caters to the needs of the individuals using it. Immersion enhances children's focus, fixation duration, and attention span. Hence, they can learn better from the immersive world. Multisensory interaction enhances engagement and navigation skills, enabling students to apply the same in the physical world. Metaverse tool offers inclusivity and digital classrooms where everybody has an avatar and cannot be discriminable. Also, inclusive education can allow students with disabilities in remote areas to access education and learning remotely.

Overall, the findings of the systematic review provided insightful information on the communication affordance of Virtual Reality for special education. The results of the study give insight into virtual reality as a source of immersion, multisensory interaction, and educational tool. The immersion of the medium improves focus and motivates students who get troubled when learning in a traditional manner. The interactive nature serves diverse learning styles of students as per their physical, cognitive, motor, or intellectual disabilities. The ASD children can work on communication and navigation skills; the dyslexia students can get to learn in a more understanding and engaging manner. The metaverse, when used as a tool of education, creates opportunities for children with special needs to develop social skills and motor skills and safely navigate through society. The technology can be engineered to include art and gamification for education purposes. Task-based VR games are a great way to educate children with special needs on necessary social survival skills. Technology offers a great scope for education. Edu-Metaverse is a theme in its infancy and has gathered interest since 2019. However, it needs to be explored on all grounds to identify its useability for education purposes. The qualitative and experimental review can work to develop an all-inclusive application of Virtual Reality to foster special education needs.

The review also identified some functional and ethical problems associated with VR education. VR technology is new and emerging, and there is sure to be less diffusion of innovation among people. There are not many experienced instructors to teach through the medium of the metaverse. For special education, VR can blur the lines between the real and virtual worlds. There is little proof that the skills learned in the virtual world can be applicable to students in the real world. The impression of being safe in the virtual world cannot be led up to the real world. The avatar in a VR environment can cause confusion and anxiety. Distant learning is a benefit of VR, but technology cannot reach all remote areas. Being on VR poses serious privacy and data theft concerns that cannot be ignored.

## Conclusion

Virtual reality is a medium of communication that has a spatial three-dimensional display. Immersive technology is attributed to the features that facilitate all branches of social and scientific education. The vast applicability of the medium has gained interest in the special education sector as well. Children with mental, physical, behavioural and social disabilities are provided education through trained educators. However, the limitation of the education system becomes a hurdle in the functionality of children as a part of society. The immersive virtual technology offers a space for special education and learning management where students can learn and apply their best skills (Bosse et al., [2022](#)).

The virtual technology features immersion, sensory presence, realism, and tangible objects and avatars with which to interact. The present study aimed to identify the features of Virtual technology that can be applicable to special education development in the Virtual world. The study has posed two basic questions on identifying affordances and analyzing their utility. The study used communication affordance theory along with a systematic literature review based on preferred reporting items for systematic review and meta-analysis of PRISMA.

The study concluded that virtual technology offers three major affordances: immersion, multisensory interaction, and the use of the metaverse as an educational tool. The lacking skills in students with disabilities observed are reduced cognition, less focus and attention, boredom, uncoordinated motor functions, lacking social interactions and communication skills, and intellectual skills as well. The research suggests that virtual technology has great potential for special education. It caters to the needs of navigation and communication, social skills, interactions with peers through avatars, problem-solving, and increasing attention and focus of students with disabilities. The virtual classrooms can enhance their performance and allow them to adopt diverse fields of education, from social sciences to medical to scientific studies. They can access all sorts of education. The VR also fosters the concept of inclusive education. The personalization feature is helpful in designing the classroom or the environment according to the requirements of the children. The environment can be customized to cater for their

specific disability. The control and authority are no longer contained within the instructor but both the instructor's children and, moreover, the designer of the VR environment.

Immersive technology is a beneficial tool for special education. However, the analysis also determined challenges that are associated with the use of VR in special education. Immersive virtual media is an engaging technology, but children can get tired of the regular use of it. Another issue associated with VR as a tool for special education is the lack of trained educators. The educators must have expertise and knowledge of diverse fields of engineering and media along with special education to effectively use the technology. The medium is spatial and can be accessed through haptic devices such as head-mounted displays, gloves, pointers or a specific uniform. This can create illness and motion sickness in students. The primary use of VR in special education is to teach students social integration, communication and navigation skills so they can socialize in the real world. However, Virtual reality technology has an opposing feature of mixing up the real and virtual worlds. The sensory presence is so real that children might not be able to differentiate the digital world from the real physical world. This causes fogging in their brains instead of recovering them.

Hence, virtual reality technology is a technology with applications in diverse fields of life, such as special education. The medium is an effective source of learning and development alongside shortfalls. The systematic literature review identified the utility and challenging features of virtual reality and immersive technologies. Future research can work on identifying each affordance analyzed through experimental analysis. The work of the field is in its infancy. The more structural and experimental analysis can open up new avenues to explore for catering special education.

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