CHAPTER -2

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter deals with the review of literature that is directly or indirectly related to the study proposed by the investigator. Resourceful information on the problem to be investigated is one of the most important steps in the planning of any research. Every piece of ongoing research needs to be connected with the work already done to attain overall relevance and purpose. The review of literature acts as a link between the studies already conducted in the field/area and the research proposed. There are mostly three stages in most of the reviews which are- finding relevant information, appraisal of relevant and contextual information and synthesizing and summarizing findings into a set of collective conclusions.

2.2 Review of Related Literature

Athanasios S. Drigas and Rodi-Eleni Ioannidou (2012) conducted a review-based research study in the field of Special Education at the Institute of Informatics and Telecommunications, NCSR Demokritos, Athens, Greece. The research is titled, "A Review on Artificial Intelligence in Special Education". This study presents an analytical overview of research conducted during the decade 2001–2010 that examined the role of Artificial Intelligence (AI) in supporting students with special educational needs, particularly those with learning difficulties or learning disabilities. The researchers focused on how AI tools have been applied in two main areas: diagnosis of learning disabilities and intervention strategies for academic improvement.

The authors adopted the definition of learning disabilities from the Individuals with Disabilities Education Act (IDEA), referring to disorders in basic psychological processes that affect a student's ability to read, write, speak, or perform mathematical tasks. The study highlights that AI applications such as expert systems, intelligent tutoring systems, and machine learning-based tools have increasingly been used to

support personalized education and real-time learner assessment. These AI-based educational approaches are designed to simulate expert human decision-making to aid in identifying learning challenges and delivering tailored instructional support.

The review concluded that Artificial Intelligence has a significant potential to bridge academic gaps for students with learning disabilities by offering timely interventions and differentiated instruction. The authors advocate for the increased integration of AI in inclusive education frameworks, emphasizing its value in both school and home learning environments. This work supports the notion that AI can transform special education by improving the quality of diagnosis, personalizing learning pathways, and ultimately promoting equity in academic achievement.

Rashi Kohli, Sparsh Phutela, Anchal Garg, and Mark Viner (2021) contributed a scholarly chapter titled "Artificial Intelligence Technology to Help Students With Disabilities: Promises and Implications for Teaching and Learning" in the Handbook of Research on Critical Issues in Special Education for School Rehabilitation Practices. This work investigates the promises of artificial intelligence (AI) in addressing the diverse learning needs of students with disabilities. The authors emphasize that with proper design and implementation, AI technology can be transformative in diagnosing learning difficulties, enhancing classroom instruction, and personalizing learning pathways.

The study explores existing AI applications, including Natural Language Processing (NLP), robotics, neural networks, and expert systems, and explains how they can support both teachers and students. These technologies aid in differentiating instruction, providing real-time feedback, and engaging learners in more interactive and adaptive educational environments. Of particular note is the way AI enables instructors to better identify academic gaps and apply targeted interventions, especially for learners with learning disabilities. The chapter also discusses AI's potential in facilitating inclusive practices by making education more accessible and responsive to individual student needs.

The authors conclude that the thoughtful integration of AI can significantly bridge learning gaps, especially for students with special educational needs, and promote a more equitable and effective educational system.

Prabal Datta Barua et al. (2022) conducted a comprehensive review titled "Artificial Intelligence Enabled Personalized Assistive Tools to Enhance Education of Children with Neurodevelopment Disorders—A Review." This study offers a wide-ranging analysis of the use of artificial intelligence (AI) and machine learning (ML) technologies in addressing learning challenges associated with neurodevelopment disorders (NDDs), such as ADHD, autism spectrum disorders (ASD), and specific learning disabilities including dyslexia.

The authors emphasize that AI-based interventions hold significant promise for enabling personalized learning strategies tailored to the cognitive and behavioral profiles of children with NDDs. By examining various AI-enabled tools—ranging from intelligent tutoring systems to emotion-aware learning platforms—the study highlights how these technologies support individualized diagnosis, improve learning engagement, and foster better educational outcomes. Notably, the review discusses how AI contributes to early identification and personalized interventions, thereby helping to bridge academic gaps for students struggling due to their disabilities.

A unique contribution of this review is its focus on the high co-morbidity of neurodevelopment and mental health disorders and how AI tools can support complex, multifaceted learning needs. The authors also explore socio-economic and environmental factors that affect the efficacy of these tools. They recommend the development of more inclusive, adaptive, and accessible AI systems that can dynamically respond to diverse learner profiles. Their findings underscore the need for a more robust, ethical, and user-centered approach in future AI development to support children with NDDs in educational contexts.

Sinan Hopcan, Elif Polat, Mehmet Emin Ozturk, and Lutfi Ozturk (2022) conducted a systematic review titled "Artificial Intelligence in Special Education: A Systematic Review" to explore recent trends, developments, and implications of AI in special education. Drawing upon 29 peer-reviewed studies published between 2008 and 2020, this review presents a comprehensive analysis of how artificial intelligence has been applied to support learners with disabilities in diverse educational contexts.

The findings indicate a growing prevalence of AI technologies, particularly software-based applications, in enhancing cognitive and affective skill development for

students with special educational needs. Notably, the review highlights a strong focus on supporting learners with autism spectrum disorders (ASD), suggesting that AI's role has been most prominent in this domain. The tools evaluated across studies often incorporate technical models like Artificial Neural Networks (ANN) and Support Vector Machines (SVM), emphasizing data-driven decision-making and personalized learning experiences. Despite the increasing technological sophistication, the authors point out a relative underrepresentation of educational models that integrate pedagogical frameworks alongside technical designs.

This review is significant to the discourse on academic gap reduction, as it provides evidence that AI-based approach though still evolving—can effectively cater to the diverse needs of learners with disabilities. However, the authors caution that while technological advances are promising, future developments must incorporate educational theory and teacher feedback to ensure that AI tools are not only efficient but also pedagogically sound and inclusive. The study concludes with strategic recommendations for improving AI integration in special education, including more interdisciplinary collaboration and emphasis on holistic learner development.

Matthew T. Marino, Eleazar Vasquez, and Jose Blackorby (2023) explore the evolving role of artificial intelligence (AI) in special education through their article "The Future of Artificial Intelligence in Special Education Technology." This conceptual discussion evaluates the potential of AI as a transformative, disruptive force within special education, offering both current observations and future projections based on early-stage evidence and theoretical insights.

The authors outline AI's developmental milestones—ranging from Alan Turing's early contributions to the emergence of deep learning—and contextualize them in relation to modern applications for individuals with disabilities. AI-based assistive technologies such as speech-to-text, voice recognition, and personalized tutoring systems are discussed as powerful tools for increasing accessibility, enhancing individualized instruction, and improving learning outcomes. Several tools, such as AI-based assessment platforms and adaptive tutoring systems (e.g., TutorAI, EducationCopilot), are cited as promising interventions that could support both students and educators.

While acknowledging the potential of AI to deliver real-time feedback and customized educational experiences for learners with physical, cognitive, and sensory impairments, the authors emphasize the need for caution. They stress that ethical considerations, teacher training, and data privacy must be integrated into AI policy and implementation frameworks. Furthermore, they advocate for substantial empirical research to examine the actual efficacy of AI-based tools before fully integrating them into educational systems.

This article is particularly relevant to the academic gap discourse, as it presents AI as a dual-purpose solution: enabling individualized learning pathways for students with disabilities while supporting educators in making data-driven instructional decisions. Its forward-looking approach provides valuable insight into how AI might shift traditional special education paradigms and assist in minimizing disparities in learning achievement.

Yolanda Mpu (2023) conducted a comprehensive literature review titled Bridging the Knowledge Gap on Special Needs Learner Support: The Use of Artificial Intelligence (AI) to Combat Digital Divide Post-COVID-19 Pandemic and beyond. The study explores how AI technologies—such as intelligent tutoring systems, speech recognition tools, and wearable devices—can personalize learning for special needs learners by adapting content, pace, and assessment methods. Mpu emphasizes that despite the growing use of AI in education, learners with disabilities are still underrepresented in research. The paper also highlights the widening digital divide post-pandemic and the need for inclusive, accessible learning environments supported by AI. Ethical concerns, data bias, and privacy issues are noted as limitations. The study advocates for equity, representation in datasets, and policy frameworks to support AI integration in special education.

Vered Vaknin-Nusbaum and Israel Rachevski (2023) conducted a study titled perpetuating the Gaps: 21st-Century Skills in Students with Learning Disabilities and Their Typically Developing Peers to examine differences in 21st-century skills among students with learning disabilities (LD) and their typically developing peers. The research explored whether these gaps differ across educational stages—high school and postsecondary. Results showed that postsecondary students, regardless of learner

type, reported higher self-assessed 21st-century skills than high school students. However, students with LD consistently scored lower in most skill areas compared to their peers. Notably, the skill gap widened over time, especially during the transition to higher education, indicating that some 21st-century competencies develop unevenly. The study highlights the need for inclusive educational strategies to cultivate essential skills for lifelong learning and workforce integration, especially among learners with disabilities.

Sahrish Panjwani-Charania and Xiaoming Zhai (2023) conducted a systematic review to explore the use of Artificial Intelligence (AI) in supporting students with learning disabilities (SWLDs). Among 16 reviewed studies, most focused on dyslexia, with limited research on dyscalculia and broader learning disabilities. Only half the studies targeted school-age children. The review identified seven AI applications—adaptive learning (most common), chat bots, facial expression analysis, communication aids, intelligent tutors, interactive robots, and mastery learning. Using the SAMR-LD model (Substitute, Augment, Modify, Redefine), the authors classified the integration levels of AI tools, noting most fell within substitution and augmentation categories. The findings highlight AI's potential to enhance learning experiences for SWLDs, but also underscore a significant research gap. Most studies concentrate on identifying disabilities rather than offering sustained educational interventions. The study calls for more empirical research to explore AI's broader, long-term role in inclusive education.

Johny Daniel (2023) investigates the persistent academic achievement gap between students with special educational needs and disabilities (SEND) and their typically developing peers in England. Drawing on data from the National Pupil Database, the study analyzed academic performance in reading, writing, and mathematics among approximately 2.5 million Year 6 students across four academic years. The research highlights significant and consistent achievement gaps, with the most pronounced deficits observed in students with intellectual disabilities. While some variation existed across different SEND categories, the overall trend showed that all SEND groups underperformed compared to their peers. Furthermore, these achievement gaps have widened over time despite existing legislative efforts to support inclusive education. The study emphasizes the urgent need to reassess current educational

policies and practices to ensure that students with SEND receive more effective support to bridge these enduring academic disparities.

R. Krishna Kumari (2024) explores the transformative potential of Artificial Intelligence (AI) in Special Education (SE), focusing on how AI can enhance learning outcomes for students with disabilities. The chapter highlights key areas where AI contributes—personalized learning, early detection of learning disabilities, and improved communication among stakeholders. AI tools can tailor instruction to individual student needs and analyze performance data to identify learning difficulties early, enabling timely interventions. The chapter also discusses ethical concerns, such as data privacy and algorithmic bias, emphasizing the need for fairness and human oversight. While AI cannot replace the empathy of human educators, it can augment teaching and support inclusive practices. Through case studies and practical insights, the work offers guidance for educators and policymakers to responsibly integrate AI into SE settings. Ultimately, it aims to empower stakeholders to leverage AI for equitable and effective education for students with disabilities.

Abdulaziz S. Alsolami (2024) investigated the effectiveness of artificial intelligence (AI) in enhancing academic skills among Saudi school-aged boys with mild intellectual disabilities (ID). Seventy students aged 9–12 were divided into experimental and control groups. The experimental group received AI-assisted instruction over ten sessions, while the control group followed the standard special education curriculum. Assessment was conducted using the Woodcock-Johnson IV test before, after, and one month post-intervention. The AI-assisted group showed significant improvements in reading and math skills, with moderate to large effect sizes ($\eta^2 = 0.685$–0.921). These gains persisted at follow-up, highlighting AI's potential in personalizing instruction and addressing learning challenges in students with ID. The study emphasized the importance of integrating AI tools within the "whole child" educational framework and called for future research to explore long-term and broader applications of AI for inclusive education across diverse learning environments.

Chalkiadakis et al. (2024) conducted a systematic review exploring the impact of Artificial Intelligence (AI) and Virtual Reality (VR) on educational inclusion for

students with disabilities. Grounded in the principles of the UN Convention on the Rights of Persons with Disabilities (CRPD), the review highlights how AI-driven adaptive systems can personalize learning by analyzing individual needs, while VR offers immersive environments that enhance experiential learning. These technologies hold promise to improve educational accessibility, engagement, and social inclusion for learners with physical, cognitive, sensory, and intellectual disabilities.

Despite the potential benefits, the review identifies several barriers to widespread adoption, such as high costs, technical challenges, and insufficient teacher training. Ethical issues, including privacy concerns and algorithmic bias, also require careful attention. The authors emphasize that AI and VR should be integrated thoughtfully within existing education systems to create equitable and inclusive learning environments. They advocate for further empirical research on the long-term effects and call for equitable access to these technologies, especially in underserved communities. Ultimately, the review underscores AI and VR as essential tools for transforming education to meet the diverse needs of all students and advance inclusive education globally.

Zhang et al. (2024) conducted the first meta-analysis to examine the effects of AI-based interventions on learning outcomes for students with disabilities (SWDs) in pre-K–12 education. Drawing on 29 quasi-experimental studies worldwide, the research reports a moderate positive effect (Hedges' g = 0.588) of AI tools—including robots, computer software, and intelligent VR systems—on SWDs' academic and social-emotional development. The study uniquely applies Cultural-Historical Activity Theory (CHAT) as a framework to analyze the complex interactions between AI tools, learners, and stakeholders such as educators and families. Despite identifying no statistically significant moderators, the authors emphasize the sociocultural context of disabilities and advocate for AI systems that promote agency and active participation of SWDs rather than a deficit-based approach. The review highlights the interdisciplinary nature of AI, its growing capabilities in natural language processing, computer vision, and machine learning, and its transformative potential for personalized and inclusive education. Finally, the study calls for more rigorous research to ensure AI tools not only enhance accessibility but also empower SWDs to contribute meaningfully in AI-mediated learning environments.

In conclusion the integration of artificial intelligence (AI) and assistive technologies has shown promising potential in addressing the unique learning needs of children with disabilities. Studies reviewed reveal that AI-driven interventions can significantly improve cognitive, emotional, and behavioral engagement, particularly through personalized learning, adaptive feedback, and interactive support. Technologies such as socially assistive robots, virtual reality, and AI-based diagnostic tools have demonstrated benefits across various disability categories—including learning, sensory, physical, intellectual, and behavioral challenges. Despite these advancements, several critical research gaps remain. Many existing studies are limited in scope, often focusing on specific disabilities or conducted in controlled settings with small sample sizes. There is also a lack of longitudinal research to assess long-term impacts, and limited exploration of real-world classroom integration. Additionally, ethical concerns around accessibility, equity, and data privacy are underexplored in practical application. This highlights the urgent need for inclusive, large-scale, and interdisciplinary research that bridges these gaps. Understanding the full impact of AI tools on engagement and learning outcomes is crucial for developing effective, equitable, and scalable educational interventions. Therefore, future research should prioritize user-centered design, inclusive testing environments, and cross-curricular implementation to ensure that AI technologies truly enhance the educational experiences of all learners, especially those with special needs.