CHAPTER-5

SUMMARY, FINDINGS AND CONCLUSION

5.1 Introduction

The investigator arrives at this stage after a rigorous exercise of analyzing the data and providing insight to make objectives more high-yielding and significant. The writing of research findings is usually the concluding task of a research endeavor. Research is directed towards the goal of discovering new knowledge which can contribute to the expansion of the ocean of knowledge.

5.2 Summary of the Study

Education is the cornerstone of personal and societal development, and equitable access to quality education remains a primary goal of inclusive schooling. However, children with learning disabilities often experience significant challenges in achieving educational outcomes equivalent to their typically developing peers. These challenges include difficulties in reading, writing, numeracy, language comprehension, and classroom participation. Traditional methods of teaching, although effective for many learners, often fall short in addressing the unique needs of students with learning disabilities. In this context, the present study investigated the role of Artificial Intelligence (AI) in bridging academic performance gaps between children with and without learning disabilities, specifically within the mainstream educational setting.

The study was conducted among a purposively selected sample of 20 students aged 15 years from mainstream schools in the Kannur district of Kerala. Among them, 10 students were identified with learning disabilities and constituted the experimental group, while 10 students without learning disabilities formed the comparison group. The students with learning disabilities were exposed to AI-integrated teaching in the areas of reading, writing, speaking (in Malayalam, English, and Hindi), and numeracy (addition, subtraction, multiplication, division, and reasoning). The study was

structured around a quasi-experimental design employing pre-test and post-test methodology.

A teacher-made test was used to assess students' performance in literacy and numeracy, adapted from the framework of the Wechsler Individual Achievement Test–Third Edition (WIAT-III). Reading comprehension, written expression, speaking ability, and mathematical operations were evaluated through simple, grade-appropriate tasks. In addition to academic tests, an observation checklist was used to track student engagement across behavioral, cognitive, and emotional domains, and a student feedback survey was conducted to gather their perspectives on the AI tools used during the intervention.

Before the AI intervention, the pre-test scores indicated a clear and significant academic performance gap between the normal students and the students with learning disabilities. The average total score of normal students was substantially higher than that of their peers with disabilities, confirming the need for an intervention. Following this, the experimental group received structured lessons supported by free and user-friendly AI tools such as Khan Academy for numeracy, Google Read Along and YouTube Kids for reading, and text-to-speech or speech-to-text tools for writing and speaking practice.

During the AI intervention, students were observed and rated across 15 behavior indicators grouped under four domains—behavioral engagement, cognitive engagement, emotional engagement, and overall improvement. The observation checklist helped capture the depth of student involvement, responsiveness, and progress in real-time classroom settings. The Likert scale format allowed the recording of behavioral trends that offered a qualitative layer to the numerical data.

Post-intervention, the experimental group underwent a post-test using the same assessment tools administered during the pre-test. The results were then analyzed using Microsoft Excel, and appropriate statistical techniques, including independent sample t-tests and paired sample t-tests, were applied to test the significance of observed differences. The pre-test scores of the normal students were also compared with the post-test scores of the students with learning disabilities to evaluate the extent to which AI-based instruction helped reduce the learning gap.

The data analysis revealed several noteworthy findings. Firstly, a paired sample t-test comparing pre- and post-test scores of students with learning disabilities showed a statistically significant improvement in performance. The mean post-test score increased markedly, indicating that AI tools were effective in improving academic achievement. Secondly, an independent samples t-test comparing the post-test scores of students with learning disabilities with the pre-test scores of normal students indicated that although a performance gap still existed, it had significantly reduced. This finding strongly supports the idea that AI can play a crucial role in narrowing learning disparities in inclusive classrooms.

In addition to test scores, the observation checklist showed that most students demonstrated strong behavioral and emotional engagement during AI-supported sessions. Items such as "The student actively participates in AI-based learning" and "The student maintains a positive attitude" received high frequencies of “Always” and “Often” responses. Cognitive engagement scores were slightly lower, especially in the ability to independently apply learned concepts, suggesting the need for continued support and reinforcement. Emotional responses were particularly positive, with students reporting enjoyment, reduced anxiety, and pride in completing AI-based tasks.

Based on the analysis of pre- and post-intervention data, it is evident that AI-integrated teaching methodologies offer significant advantages for children with learning disabilities. The tools used were not only accessible and free but also adaptive, visually supportive, and learner-friendly. They allowed for repetition, immediate feedback, and multimodal learning—all of which are essential for students with special learning needs.

Overall, the study supports the hypothesis that AI tools can bridge learning gaps between children with and without learning disabilities, particularly in the domains of literacy and numeracy. While the intervention did not completely eliminate the performance gap, it considerably reduced it and led to improvements in student engagement, self-esteem, and academic participation.

Hence, this study emphasizes the potential of technology to transform inclusive education. By implementing AI tools in a structured and meaningful way, teachers can address diverse learning needs and create equitable learning opportunities for all

students. This research adds to the growing body of evidence that AI, when used responsibly and with pedagogical intent, can significantly enhance the learning experience of students with disabilities, empowering them to reach closer to their full academic potential.

5.3 Statement of the Problem

The problem of the present study is stated as A COMPARATIVE STUDY ON THE EFFECTIVENESS OF ARTIFICIAL INTELLIGENCE IN BRIDGING LEARNING GAPS BETWEEN CHILDREN WITH AND WITHOUT LEARNING DISABILITIES.

5.4 objectives of the study

1. To assess and compare the academic performance of children with and without learning disabilities in reading, writing, and numeracy.
2. To evaluate the effectiveness of AI tools in improving the post-test academic performance of students with learning disabilities compared to their pre-test academic performance
3. To determine whether AI-based instruction reduces the learning gap between students with learning disabilities and their typically developing peers.
4. To examine the effect of AI-based instructional tools on the behavioral, cognitive, and emotional engagement of children with learning disabilities in comparison to traditional teaching methods.

5.5 Sample

The sample for the present study consists of 20 students aged 15 years, selected from Chembilod Higher Secondary Schools in the Kannur district of Kerala. The sample was purposefully chosen to include 10 students with and 10 students without learning disabilities, allowing for a comparative analysis of academic performance before and after the intervention.

5.6 Research Tools

The study used a teacher-made achievement test and an observation checklist, to assess academic performance and engagement levels of the students.

5.7 Research Methodology

The study adopted a quasi-experimental design with a pre-test and post-test approach to examine the effectiveness of AI-integrated instruction for students with learning disabilities. A purposive sample of 20 students aged 15 from mainstream schools in Kannur district was selected, including 10 students with learning disabilities and 10 typically developing peers. The research tools included a teacher-made achievement test and an observation checklist. Data were collected before and after the AI intervention, and statistical analysis using t-tests was conducted to evaluate academic improvement and engagement levels, comparing pre-test, post-test, and between-group performance.

5.8 Findings of the Study

The main findings that come out of the study according to objectives are listed below:

Objective 1- To assess and compare the academic performance of children with and without learning disabilities in reading, writing, and numeracy.

Findings related to Objective 1 of the study:

- Students without learning disabilities scored higher than students with learning disabilities in literacy and numeracy assessments.
- The largest performance gap was observed in numeracy skills between the two groups.
- Literacy scores showed consistent differences, with students with learning disabilities scoring lower.
- Overall academic performance was significantly better among students without learning disabilities.

Objective 2- To evaluate the effectiveness of AI tools in improving the post-test academic performance of students with learning disabilities.

Findings related to Objective 2 of the study:

- Post-test scores in literacy improved notably after AI tool intervention.
- Numeracy skills showed significant gains in post-tests following the use of AI instructional tools.
- Total academic performance increased by approximately 12-15% after AI-based learning sessions.
- Students demonstrated better retention and application of concepts with AI-supported instruction.

Objective 3- To determine whether AI-based instruction reduces the learning gap between students with learning disabilities and their typically developing peers.

Findings related to Objective 3 of the study:

- The gap in literacy scores between students with and without learning disabilities narrowed after AI intervention.
- Numeracy performance differences also reduced but remained statistically significant.
- AI tools contributed to improved overall academic parity between the two groups.
- The learning gap reduction was more pronounced in literacy than in numeracy.

Objective 4 - To examine the effect of AI-based instructional tools on the behavioral, cognitive, and emotional engagement of children with learning disabilities in comparison to traditional teaching methods.

Findings related to Objective 4 of the study:

- Engagement levels of students with learning disabilities increased during AI-supported lessons compared to traditional methods.
- Improved academic motivation was observed in students using AI tools.

- Students showed higher participation and interest in learning activities with AI integration.
- Teachers reported positive changes in student attitudes and engagement following AI instruction.

5.9 Educational Implications of the Study

This study offers significant educational implications for enhancing inclusive teaching practices and optimizing learning outcomes for children with learning disabilities (LDs) through the integration of artificial intelligence (AI) tools. One of the foremost implications is the demonstrated effectiveness of AI in improving academic performance in core areas such as literacy and numeracy. The notable increase in post-test scores among LD students indicates that AI tools can serve as powerful instructional aids, providing personalized support tailored to individual learning needs, which traditional teaching methods may lack.

Furthermore, the study shows that AI-assisted instruction can help narrow the learning gap between students with and without LDs. This suggests that educational institutions can adopt AI-based interventions to promote equity and reduce disparities in achievement, ensuring that every learner has an opportunity to succeed regardless of their learning challenges. The improved engagement levels—cognitive, behavioral, and emotional—also highlight the motivational aspect of AI tools, making learning more interactive, enjoyable, and meaningful for students who often struggle to stay focused in conventional classroom settings.

Teachers can also benefit from these technologies by using AI-generated analytics to track student progress and identify specific areas requiring intervention. This data-driven approach enables more effective lesson planning and individualized instruction. Additionally, the study underscores the need for teacher training programs to include digital literacy and AI integration skills, so educators can confidently and effectively implement such tools in diverse classroom settings.

In conclusion, the findings encourage educational policymakers and school administrators to incorporate AI-based learning technologies into special education curricula. With appropriate implementation, these tools have the potential to foster

inclusive education, bridge achievement gaps, and significantly enhance the overall educational experience and outcomes for children with learning disabilities.

5.10 suggestions for further study

The investigator while conducting research work observed that still there are many more research area to be researched, some of the further studies that can be carried out are as follow

1. Longitudinal Impact Studies:- Future research can explore the long-term effects of AI-based learning tools on academic retention and progression in children with learning disabilities.
2. Comparative Studies Across Age Groups:- Studies can be conducted to compare the effectiveness of AI tools across different age groups or grade levels to identify developmental variations in outcomes.
3. Tool-Specific Effectiveness:- Research can focus on evaluating specific AI applications or platforms to determine which tools are most effective for different types of learning disabilities.
4. Teacher Perception and Readiness:-Investigate teachers' attitudes, preparedness, and challenges in implementing AI tools in inclusive classrooms to inform professional development programs.
5. Parent Involvement and Feedback:- Studies can examine the role of parents in supporting AI-based learning at home and their perceptions of its effectiveness.
6. Cost-Effectiveness Analysis:- Future studies could assess the economic feasibility and cost-benefit ratio of implementing AI tools in low-resource educational settings.
7. Integration with Traditional Pedagogy:- Explore models of blended instruction combining AI with traditional teaching strategies to evaluate their combined impact on learning outcomes.
8. Customization for Specific Disabilities:- Investigate how AI tools can be adapted or customized for specific learning disabilities like dyslexia, dysgraphia, or dyscalculia.
9. Impact on Non-Academic Skills:- Conduct research on how AI-assisted learning influences soft skills such as self-confidence, communication, and problem-solving in students with LDs.

10. Cross-Cultural Validation:- Comparative studies across different regions or cultural contexts can assess whether AI tools are equally effective and inclusive in diverse educational environments.

5.11 Conclusion

The present study critically examined the role of artificial intelligence (AI)-based instructional tools in supporting children with learning disabilities and bridging the academic gap between them and their typically developing peers. The research findings indicate a significant improvement in literacy and numeracy performance among students with learning disabilities after the implementation of AI tools, highlighting the potential of these technologies to personalize learning, reinforce concepts, and offer consistent feedback. Additionally, the study revealed notable enhancements in behavioral, cognitive, and emotional engagement, demonstrating that AI-based instruction positively influences student motivation, focus, and classroom interaction compared to traditional teaching methods.

The literature review further reinforced these findings, showing that AI-assisted educational technologies have a broad impact across various disabilities—from improving mobility and communication in children with physical or sensory challenges to enhancing emotional regulation and social interaction in those with neurodevelopment and behavioral disorders. However, despite these advancements, several critical research gaps persist. There is a clear need for longitudinal studies to measure sustained outcomes, evaluations of specific AI tools, and a better understanding of teacher and parent perspectives. Issues like ethical concerns, accessibility, and the digital divide must also be addressed to ensure equitable implementation.

This study makes a valuable contribution to the growing body of research on inclusive education, suggesting that AI has the capacity to transform special education by offering scalable, adaptive, and data-informed learning experiences. Educational institutions must now consider integrating AI tools not as replacements but as supplementary aids that support personalized and inclusive teaching. Future research and policy efforts should aim at refining AI tools, ensuring accessibility, training educators, and evaluating implementation models across diverse learning environments. Ultimately, embracing AI in education holds promise for fostering

equitable learning opportunities and supporting the holistic development of children with learning disabilities.