

An Experimental Study on the Impact of Inclusive Curriculum Adaptation on the Academic Performance of Students with Multiple Disabilities

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Abstract

This experimental study explores the impact of inclusive curriculum adaptation on the academic performance of students with multiple disabilities in government schools. Conducted over two months, the study involved two inclusive schools in Chennai, focussing on Class 4 students and three core subjects namely science, social science and mathematics, as outlined in the Samacheer Kalvi Curriculum Framework. The sample comprised 10 students with multiple disabilities, with five students selected from each school.

The intervention was carried out by the teacher trainees, who employed various curriculum adaptation strategies to address the diverse learning needs of the students. These strategies included simplifying lesson content, integrating visual and tactile aids, providing hands-on learning experiences, and offering individualised instruction and assessments. The aim was to create an inclusive learning environment that supports students with multiple disabilities in achieving their academic potential.

Data collection involved pre-intervention and post-intervention academic performance assessments, complemented by qualitative observations of student engagement and participation during classroom activities. The findings revealed a marked improvement in students' academic outcomes following the intervention. Students exhibited enhanced comprehension, better retention and increased participation in the subjects of science, social science and mathematics. Furthermore, qualitative data highlighted an improvement in student-teacher interaction and peer collaboration within the classroom setting.

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The study highlights the effectiveness of curriculum adaptation as a vital tool for fostering inclusive education in government schools. It emphasises the necessity of empowering teacher trainees with the skills required to implement adaptive teaching practices and modify instructional approaches in order to meet the varied needs of learners. This research contributes to the broader discourse on inclusive education, providing evidence for positive outcomes of adaptive curriculum strategies in enhancing the academic success of students with multiple disabilities.

INTRODUCTION

Inclusive education aims to provide equitable learning opportunities for all students, including those with diverse needs and abilities. It seeks to create a supportive educational environment to ensure participation, engagement and academic growth for every learner, irrespective of their disabilities. However, students with multiple disabilities often face significant challenges in traditional classrooms, where standard teaching methods and curriculum frameworks may not accommodate their unique learning needs. These students may experience difficulties in accessing content, engaging with peers and demonstrating their knowledge, leading to disparities in academic performance and overall educational outcomes.

The Samacheer Kalvi Curriculum Framework emphasises inclusivity in primary education. However, for students with multiple disabilities, achieving meaningful inclusion requires targeted interventions and strategies to adapt to the curriculum. Inclusive curriculum adaptation involves modifying teaching practices, lesson content, learning materials and assessments, to provide for the specific needs

of students with disabilities. It emphasises the use of simplified content, visual and tactile aids, hands-on learning experiences, and individualised instruction to bridge the learning gaps and ensure that students can actively participate in the classroom.

The role of teacher trainees in implementing these adaptations in teaching practice is essential. They bring innovative approaches to the classroom, adapting their methods to accommodate the varied learning styles of students with multiple disabilities. Through focused interventions, teacher trainees can create an environment that supports academic growth, accepts confidence and enhances classroom engagement for students with multiple disabilities.

This research explores the impact of inclusive curriculum adaptation strategies on the academic performance of Class 4 students with multiple disabilities, studied in the subjects of science, social science and mathematics under the Samacheer Kalvi Curriculum Framework. By using experimental methods, the study examines how simplifying lesson content, integrating visual

and tactile aids, providing hands-on learning experiences, and offering individualised instruction can transform the learning outcomes for students with multiple disabilities.

OBJECTIVES OF THE STUDY

1. To assess the impact of inclusive curriculum adaptation on the academic performance of students with multiple disabilities
2. To evaluate engagement and participation during classroom activities
3. To analyse the role of the teacher trainees in implementing adaptive teaching practices

MULTIPLE DISABILITIES

Children with multiple disabilities experience a combination of impairments, such as intellectual, physical, sensory or behavioural challenges. Multiple disabilities often require specialised teaching strategies and individualised support to ensure access to the curriculum. Teachers must adapt inclusive curriculum frameworks like the Universal Design for Learning (UDL) to address the unique and diverse needs of these learners effectively for children with multiple disabilities.

UDL PRINCIPLES IN SUPPORTING STUDENTS WITH MULTIPLE DISABILITIES

The Universal Design for Learning (UDL) is a research-based framework that provides a flexible approach

to teaching by accommodating the variability of all learners. It is built around three core principles.

Multiple Means of Engagement

This implies sustaining interest and motivation by providing choices in how students participate. For example, using sensory activities (such as tactile or auditory stimuli) to engage students with sensory impairments.

Multiple Means of Representation

This means presenting information in varied formats to cater to different learning needs. For example, using large-print materials, audio descriptions or 3D models for students with visual or cognitive impairments.

Multiple Means of Action and Expression

It involves allowing students to demonstrate knowledge in diverse ways. For example, letting students use verbal responses, tactile tools or assistive devices to complete assessments.

INCLUSIVE CURRICULUM ADAPTATION

Inclusive curriculum adaptation for children with multiple disabilities involves modifying educational content, teaching strategies and classroom environment to meet their unique needs. This approach is grounded in principles of equity, UDL and collaboration among educators, families and specialists. Key strategies include using multisensory materials, assistive technologies, differentiated instruction, and

fostering social-emotional learning. By breaking down tasks into manageable steps and creating accessible learning space, educators can ensure active participation and meaningful learning for all students. Such adaptations not only support children with multiple disabilities but also promote inclusivity,

understanding and growth in the entire classroom community.

REVIEW OF LITERATURE

The following table summarises 10 key studies that form the foundation of this research on the impact of inclusive curriculum adaptation on academic performance of students with multiple disabilities.

Table 1
Review of Literature

S. No.	Author(s) and Year	Title	Key Findings	Relevance to the Current Study
1.	Sharma et al. (2019)	Inclusive Education Practices in Primary Schools	Highlighted the role of curriculum modification in enhancing engagement and retention among students with disabilities	Supports the need for curriculum adaptation strategies in inclusive classrooms
2.	Mittal and Ghosh (2021)	Role of Teacher Training in Inclusive Education	Found that teacher training significantly improves the ability to implement inclusive teaching practices effectively	Reinforces the importance of training teacher trainees for inclusive education interventions
3.	Kumar et al. (2020)	Impact of Visual Aids on Learning Outcomes	Demonstrated that visual aids significantly enhance academic performance in science and mathematics	Aligns with the study's use of tactile and visual aids to support learning
4.	Johnson and Miller (2018)	Individualised Instruction for Students with Disabilities	Showed that individualised instruction improves comprehension and builds students' confidence	Justifies the use of tailored teaching approaches for students with multiple disabilities

5.	Gupta et al. (2017)	Peer Collaboration in Inclusive Classrooms	Found that peer collaboration fosters social interaction and academic growth among students with disabilities	Supports the inclusion of group activities in the intervention
6.	Thomas and Samuel (2020)	Inclusive Strategies in Mathematics Education	Demonstrated the effectiveness of manipulatives and real-life applications in teaching mathematical concepts	Validates the use of manipulatives in the study's intervention in mathematics
7.	Wilson et al. (2016)	The Role of Simplified Content in Inclusive Education	Simplifying lesson content reduces cognitive load and improves learning outcomes for students with disabilities	Reinforces the use of simplified content as part of the intervention
8.	Singh and Mehta (2021)	Hands-on Learning in Inclusive Classrooms	Found that hands-on learning experiences improve engagement and retention in students with disabilities	Aligns with the study's emphasis on hands-on activities across subjects
9.	Patel and Rao (2019)	Assessing the Impact of Adaptive Assessments	Concluded that modified assessments help students demonstrate their knowledge more effectively	Supports the use of customised assessments in the current study
10.	Fernandez et al. (2022)	Teacher-student Relationships in Inclusive Education	Positive teacher-student interactions boost motivation and participation among students with disabilities	Justifies the focus on building teacher-student rapport during the intervention

PURPOSE OF THE STUDY

The study evaluates the impact of inclusive curriculum adaptations on academic performance and assesses the effectiveness of UDL strategies in creating inclusive learning environments for students with multiple disabilities.

METHODOLOGY

Study Design

The study utilised an experimental design with pre- and post-intervention assessments to evaluate the academic performance of students with multiple disabilities.

Sample

1. *Participants:* The sample comprised 10 students with multiple disabilities, five each from two government schools in Chennai.
2. *Class level:* Class 4
3. *Subjects:* Science (Lesson 1: My Body), social science (Lesson 1: Our India) and mathematics (Lesson 1: Numbers)

4. *Grouping:* Students were categorised into high, middle and low performers based on their pre-test scores.

Table 2
Description of Sample

Student	Disabilities
Sample 1	Visual and Cognitive
Sample 2	Hearing and Physical
Sample 3	Cognitive and Speech
Sample 4	Visual and Physical
Sample 5	Sensory and Cognitive
Sample 6	Autism and Hearing
Sample 7	Physical and Cognitive
Sample 8	Speech and Sensory
Sample 9	Hearing and Cognitive
Sample 10	Physical and Sensory

Intervention

The teacher trainees implemented the intervention using inclusive curriculum adaptation strategies designed to address the unique learning needs of the students with multiple disabilities. The intervention was implemented for three months under which three classes were conducted per week.

Table 3
Lesson Plan for Children with Multiple Disabilities (Aligned with UDL)

Subject	Science (My Body)	Social Science (Our India)	Mathematics (Numbers)
Objective	Students will identify major body parts and their functions.	Students will learn about India's geographical features and national symbols.	Students will understand place value and compare the numbers.

Introduction	- Display a chart showing parts of the body. - Use a model or a doll to demonstrate body parts.	- Show a large map of India with physical features marked (mountains, rivers, etc.) - Display flashcards of national symbols (flag, emblem, etc.).	- Present a number chart with highlighted digits. - Use objects to count and form numbers (for example, beads or blocks).
Activity 1	- Allow students to touch and identify body parts on a 3D model. - Play a song about body parts (for example, 'Head, Shoulders, Knees and Toes').	- Use tactile maps with raised surfaces to locate mountains and rivers. - Match pictures of national symbols to their names.	- Use manipulatives (for example, blocks) to represent numbers and explain place value (for example, tens and ones).
Activity 2	- Conduct a group activity where students name senses and their corresponding organs (for example, eyes for seeing).	- Create a matching activity where students link physical features to their locations (for example, Himalayas = mountains).	- Students compare numbers using 'greater than' or 'less than' symbols on flashcards.
Sensory Activity	- Use textured materials (for example, rough, soft, smooth, etc.) for students to feel and associate with skin.	- Provide cut-outs of India's map and ask students to trace boundaries with their fingers.	- Provide tactile number cards to allow students to feel and identify digits.
Assessment	- Ask students to point out and name body parts on a model. - Conduct a Q&A session where students identify senses linked to objects (for example, bell = hearing).	- Practical assessment: Students identify and name the states or physical features using a map.	- Practical task: Students build numbers with blocks and explain their place value.
Closure	- Recapitulate the functions of body parts using a fun quiz or discussion.	- Summarise the key points about India's geography and symbols through group discussion.	- Recap place value concepts using a simple quiz or student presentation.

This lesson plan integrates science My Body, social science Our India and mathematics Numbers to accommodate students with multiple disabilities using Universal Design for Learning (UDL) principles, ensuring engagement, accessibility and inclusivity.

I. Science (Class 4 Term 1)

Lesson 1: My Body Concepts:

1. Structure and function of human body parts (for example, eyes, ears, nose, skin, etc.)
2. Importance of sense organs
3. Introduction to the skeletal system
4. Maintaining hygiene and health

II. Social Science (Class 4 Term 1)

Lesson 1: Our India Concepts:

1. Physical features of India (mountains, plains, plateaus rivers, etc.)
2. States and Union Territories of India
3. National symbols (flag, emblem, animal, bird, etc.)

III. Mathematics (Class 4 Term 1)

Lesson 1: Numbers Concepts:

1. Place value and face value (up to six digits)
2. Comparing and ordering numbers
3. Rounding numbers to the nearest 10, 100 and 1000

Data Collection

1. *Quantitative Data:* This refers to the pretest and post-test scores for academic performance. High, middle and low levels were recorded for each subject.
2. *Qualitative Data:* Classroom observations captured student engagement, participation and student–teacher interactions.

Hypothesis

The implementation of inclusive curriculum adaptation strategies significantly improves the academic performance of students with multiple disabilities in science, social science and mathematics in Lesson 1.

RESULT

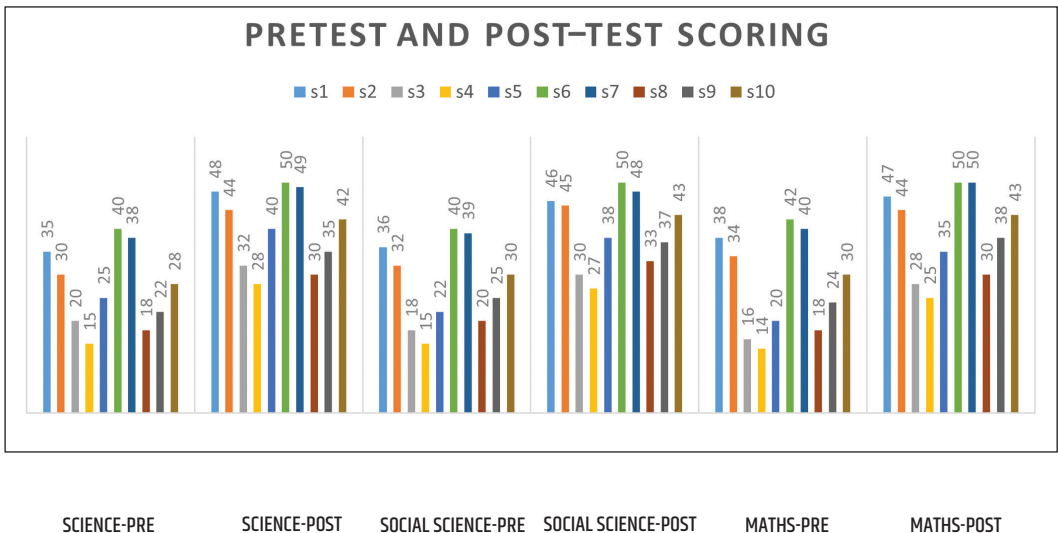
Table 4
Pretest and Post-test in Science, Social Science and Mathematics

S. No.	Sample	Science		Social Science		Mathematics	
		Pretest	Post-test	Pretest	Post-test	Pretest	Post-test
1.	Student 1	35	48	36	46	38	47
2.	Student 2	30	44	32	45	34	44
3.	Student 3	20	32	18	30	16	28
4.	Student 4	15	28	15	27	14	25

5.	Student 5	25	40	22	38	20	35
6.	Student 6	40	50	40	50	42	50
7.	Student 7	38	49	39	48	40	50
8.	Student 8	18	30	20	33	18	30
9.	Student 9	22	35	25	37	24	38
10.	Student 10	28	42	30	43	30	43
Total Scoring Average		27.1	39.8	27.7	39.7	27.6	39.0

Table 5
Overall Performance across Subjects

Subject	Pretest Average	Post-test Average	Improvement (Marks)	Improvement (per cent)
Science	27.1	39.8	+12.7	46.8
Social Science	27.7	39.2	+11.5	41.5
Mathematics	27.6	39.0	+11.4	41.3



*Figure 1: Pretest and post-test scoring for subjects
(Science, Social Sciences and Mathematics)*

INTERPRETATION

The analysis of the pretest and post-test scores across science, social science and mathematics indicates a consistent improvement in the academic performance of students with multiple disabilities. The average for each subject, both before and after the intervention, were calculated to evaluate the impact of inclusive curriculum adaptation strategies.

I. Science:

- Pretest average: 27.1
- Post-test average: 39.8
- Improvement: +12.7 marks (46.8 per cent increase)

II. Social Sciences:

- Pretest average: 27.7
- Post-test average: 39.2
- Improvement: +11.5 marks (41.5 per cent increase)

III. Mathematics:

- Pretest average: 27.6
- Post-test average: 39.0
- Improvement: +11.4 marks (41.3 per cent increase)

The improvement across all three subjects highlights the consistent effectiveness of the intervention strategies applied during Lesson 1.

The results clearly demonstrate that the implementation of inclusive curriculum adaptation strategies significantly enhanced the academic performance of students with

multiple disabilities. The consistent improvement across science, social science and mathematics suggests that these strategies effectively addressed the learning needs of these students.

- Science showed the highest improvement (46.8 per cent), reflecting the success of hands-on or visually-driven strategies.
- Social science (41.5 per cent) and mathematics (41.3 per cent) also exhibited substantial gains, suggesting that tailored teaching methods, like contextual learning and practical examples contributed to these outcomes.

The findings emphasise the importance of inclusive practices in creating equitable learning opportunities for all students, enabling them to achieve better academic outcomes and fostering a sense of accomplishment.

OVERALL PERFORMANCE

The data underscores the efficacy of the inclusive curriculum adaptation strategies in enhancing the learning outcomes of students with multiple disabilities across the core subjects. The consistent improvement in all three subjects demonstrates the adaptability and effectiveness of the approach, fostering better engagement and comprehension among the students.

RECOMMENDATIONS

Continued implementation of inclusive strategies

Schools should continue to adopt and refine inclusive curriculum adaptation strategies to cater to the diverse needs of students with multiple disabilities.

Subject-specific adaptations

Modified adaptations for subjects, like science, social science and mathematics should be further developed to address unique learning challenges in each subject.

Teacher training

Teachers should be trained regularly in inclusive teaching methods to ensure effective implementation of strategies that enhance student outcomes.

Monitoring and feedback

A structured system for ongoing monitoring and feedback should be established to track students' progress and make necessary adjustments to the strategies.

Resource allocation

Sufficient resources, including assistive technologies, teaching aids and support staff, should be provided to ensure the success of inclusive curriculum strategies.

Parent and community involvement

Engaging parents and the broader community in the learning process can help create a supportive environment for students with disabilities.

CONCLUSION

The findings of this study clearly demonstrate that the implementation of inclusive curriculum adaptation strategies has a significant positive impact on the academic performance of students with multiple disabilities. The improvement percentages— 46.8 per cent in science, 41.5 per cent in social science, and 41.3 per cent in mathematics—highlight the effectiveness of these strategies in fostering better understanding and engagement.

By investing in inclusive curriculum adaptation educational approaches, schools can create an equitable learning environment where all students, regardless of their disabilities can achieve their full academic potential. These results advocate for the widespread adoption of inclusive practices as a critical component of education systems worldwide.

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