

Inclusive Pedagogical Practices for Teaching Mathematics to Students with Learning Disabilities: An Indian Perspective in the Light of NEP 2020

Dr. Santosh Kumari^{1*}, Mrs Rajbir Kaur², Mrs. Manjot Kaur³

¹Assistant Professor, Department of Education, Guru Nanak Dev University, Amritsar

^{2,3}Research Scholar, Department of Education, Guru Nanak Dev University, Amritsar

***Corresponding Author**

Dr. Santosh Kumari

Assistant Professor, Department of Education, Guru Nanak Dev University, Amritsar

ABSTRACT

Inclusive pedagogical practices enable teachers to respond to learner diversity through flexible, learner-centered, and evidence-based approaches to teaching to promote full participation and achieve learning outcomes for all students. This paper critically analyzes 17 national and international studies on inclusive pedagogical practices in mathematics education focusing on students with learning disabilities. This paper considers evidence-based practices including Universal Design for Learning (UDL), differentiated instruction, the CRA framework, multisensory teaching, collaborative learning, assistive technologies, and formative assessment, among others. This paper examines the importance of the above practices in the context of Indian education and the goals of the NEP 2020. The National Education Policy (NEP) 2020 has renewed India's commitment to inclusive and equitable "education through various initiatives including the emphasis on competency-based learning, experiential learning, multilingual education, and ICT, among others, and continuous professional development for teachers. The adaptations of inclusive pedagogical practices in the mathematics education classroom in India are thus possible, but only with ongoing investments in teacher professional development, the early identification of learning disabilities, the use of inclusive assessment practices, and the flexible curriculum, as well as the appropriate educational technologies.

Keywords: Inclusive Pedagogy, Mathematics Education, Learning Disabilities, Dyscalculia, Universal Design for Learning, NEP 2020, Inclusive Education.

INTRODUCTION

The United Nations states that education is a basic human right and a tool to achieve equality and social justice. Sustainable Development Goal 4 (SDG 4) of the United Nations Educational, Scientific and Cultural Organization (UNESCO) states that inclusive and equitable quality education is imperative for all learners (UNESCO, 2015). The phenomenon of inclusive education has evolved globally from a movement centered on human rights to an approach focused on evidence and valuing the diversity of learners and meeting the goal of democratic school participation (UNESCO, 2020).

All streams of learning incorporate mathematics, which helps develop logical reasoning and critical thinking to solve problems. Students with learning disabilities, particularly dyscalculia, have persistent difficulties with number sense, mathematical reasoning, and calculation (Butterworth, Varma, & Laurillard, 2011). These difficulties negatively affect their academic achievement and also their self-confidence and self-motivation. Mathematics helps develop logical reasoning and critical thinking (Geary, 2013). However, learning disabilities negatively affect students' number sense, mathematical reasoning and conceptual understanding (Butterworth et al., 2011; Geary, 2013).

The Rights of Persons with Disabilities Act, 2016, Samagra Shiksha and most importantly the NEP 2020, have strengthened the inclusive education vision in India. The NEP 2020 focuses on inclusive and equitable education, a competency-based curriculum, foundational literacy and numeracy, multilingual classrooms, experiential learning, and the integration of technology, and ongoing teachers' professional development. These policies provide the basis for inclusivity in mathematics classrooms to help all students develop their mathematical ability to the best of their capability.

With the advancement of research on inclusive pedagogies in mathematics education, it becomes necessary to assess those findings and determine their potential impacts on the School system in India. This paper endeavors to review some of the major national and international research works, describe some of the instructional strategies based on evidence, analyze the NEP 2020, identify the existing gaps, and put forward recommendations to enhance inclusive mathematics education in India.

OBJECTIVES

The objectives of this paper are

Define learning disabilities and inclusion in mathematics education.

Review national and international research on inclusive mathematics education.

Interpret the sections of the National Education Policy (2020) regarding inclusive mathematics education.

Summarize successful mathematics teaching methods for students with learning disabilities.

Put forward evidence-based recommendations to enhance inclusive mathematics classrooms in India.

LEARNING DISABILITIES IN MATHEMATICS

Learning disabilities (LD) are neurodevelopmental disorders that affect an individual's ability to acquire, organize, retain, understand, and use academic skills, despite average or above-average intelligence and adequate learning opportunities. Specific Learning Disorder is characterized by persistent difficulties in reading, writing, and mathematics that significantly affect academic achievement and everyday activities. (Diagnostic and Statistical Manual of Mental Disorders (DSM-5, American Psychiatric Association, 2013)).

Dyscalculia is the most well-known mathematics-related learning disability. It has been estimated to occur in 3-7% of the population, although there is variation with different diagnostic criteria. (Shalev et al., 2000; Landerl et al., 2009; Moll et al., 2014). People with dyscalculia have persistent problems with comprehending and recognizing relationships with numbers, calculations, recall of mathematical facts, understanding place value, and solving mathematical problems. (Butterworth et al., 2011; Prince and Ansari 2013).

Students with mathematics learning disabilities often have:

Poor number sense and quantity recognition. (Joordan, Kaplen & Hanich, 2002).

Difficulty interpreting mathematical symbols. (Butterworth et al, 2011).

Insufficient working memory to support calculations. (Garry, 2013).

Difficulty sequencing mathematical procedures. (Swanson & Jerman, (2006)).

Difficulty solving word problems. (Gersten et al, 2009).

High levels of mathematics anxiety which contributes to a lack of confidence and participation in the classroom. (Ashcraft & Karise, 2007).

Weak STFR (situation, task, footage, response) and poor transfer of mathematical knowledge to the real world.

These issues result in low self-confidence, avoidance of mathematics, and low participation in classroom activities. This creates a need for mathematics teachers to implement teaching strategies that are based on reliable research in order to provide a wide range of learning opportunities and ensure equal participation of all students.

Inclusive Pedagogical Practices: Concept and Principles

Inclusive pedagogy is an approach that considers variability in learners as a normal occurrence in any classroom situation. It aims to develop learning opportunities that benefit all learners, including those with disabilities, rather than creating separate learning opportunities for them. The Inclusive Pedagogy Approach (IPA) is based on three main assumptions: (1) teaching should expect and welcome human differences, (2) teachers have a responsibility to teach all learners, and (3) teaching practices should offer learning opportunities to all, as opposed to differentiating learners into ability groups. (Florian and Black-Hawkins (2011))

METHODOLOGY

This study uses the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework, and relies on Web of Science and Scopus for extensive coverage and high reliability in academic sourcing.

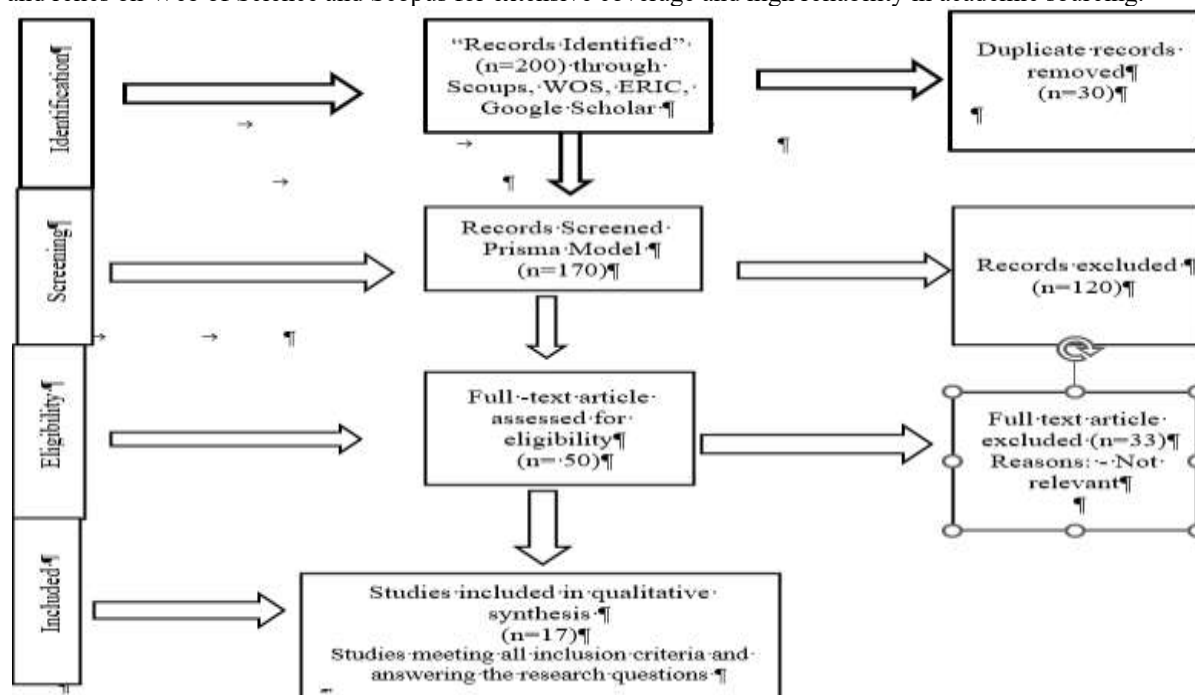


Figure 1: PRISMA Flow Diagram

Review of Research on Inclusive Pedagogical Practices in Mathematics Education

S. No.	Author(s) & Year	Country	Research Design	Participants	Inclusive Pedagogical Practice	Major Findings	Implications for Mathematics Education
1	David W. Johnson & Roger T. Johnson (2017)	USA	Experimental	School students	Cooperative Learning	Improved mathematical achievement and peer interaction.	Cooperative learning enhances participation in inclusive mathematics classrooms.
2	Mel Ainscow (2020)	UK	Review	Schools	Inclusive Pedagogy	Teacher collaboration promotes successful inclusion.	Inclusive teaching practices improve equitable access to mathematics learning.
3	David H. Rose & Anne Meyer (2018)	USA	Conceptual	K–12 Education	Universal Design for Learning (UDL)	Multiple means of engagement, representation, and expression support diverse learners.	UDL strengthens conceptual understanding in mathematics.
4	Carol Ann Tomlinson (2017)	USA	Review	School Students	Differentiated Instruction	Instruction adapted to learner readiness improves learning outcomes.	Differentiated mathematics instruction benefits students with learning disabilities.
5	Barr & Mavropoulou (2021)	Australia	Action research; qualitative data	5 adolescents with mild intellectual disability + 3 mathematics teachers	Individualised curriculum accommodations	The study examined how individualised accommodations could support mathematics learning in inclusive secondary classrooms.	Mathematics teachers should adapt curriculum content, instructional methods and learning supports according to individual needs.
6	Myers et al. (2021)	USA/international literature	Meta-analysis	45 studies; 49 interventions involving secondary	Technology-based, schema-based, visual	The review identified several intervention categories	Secondary mathematics instruction should incorporate

				students with mathematics difficulties	representation and cognitive-based interventions	effective for improving mathematics achievement among adolescents with mathematics difficulties.	evidence-based interventions, particularly visual, schema-based and technology-supported approaches.
7	UNESCO (2020)	International	Policy Report	Global	Inclusive Education Policy	Inclusive education is fundamental to equitable quality education.	Policy support is essential for inclusive mathematics education.
8	NCERT (2023)	India	Curriculum Framework	School Education	Competency-Based Mathematics	Activity-based and learner-centred approaches improve mathematical understanding.	Aligns mathematics teaching with NEP 2020.
9	Schnepel, Sermier Dessemontet & Moser Opitz (2022)	Switzerland	Longitudinal comparative study	100 primary-school pupils with intellectual disabilities; 44 inclusive, 56 special-school pupils	Inclusive mathematics education	Mathematics achievement was measured at the beginning and end of a school year to compare inclusive and special-school settings.	Inclusive placement can provide meaningful opportunities for mathematical development, but instructional quality and appropriate support remain essential.
10	Jo Boaler (2022)	USA	Mixed Methods	Secondary Students	Growth Mindset & Inquiry-Based Learning	Student confidence and achievement improved through collaborative mathematical inquiry.	Encourages inclusive participation in mathematics classrooms.
11	Ministry of Education (2020)	India	Policy Document	National	NEP 2020	Recommendations equitable, inclusive, flexible, and competency	Supports inclusive mathematics pedagogy

						-based education.	and teacher preparation.
12	Douglas H. Clements & Julie Sarama (2021)	USA	Experimental	Primary Students	Technology-Integrated Mathematics	Digital learning tools enhanced conceptual understanding.	Educational technology can support learners with mathematical difficulties.
13	UNICEF (2021)	International	Global Report	Schools	Inclusive Learning Environment	Inclusive classrooms improve participation and educational equity.	Schools should create accessible mathematics learning environments.
14	Nelson et al. (2022)	USA/international literature	Systematic review of research syntheses	36 syntheses containing 836 studies and 32,495 participants	Mathematics interventions for students with LD/MLD/MD	Research was concentrated on word problems, fractions, computer-assisted learning and schema-based instruction; relatively few participants had clearly defined mathematics learning disabilities.	More research should specifically include students with diagnosed mathematics learning disabilities and examine broader outcomes beyond achievement.
15	Radzi & Mahmud (2025)	International	PRISMA systematic literature review	22 studies from Scopus and Web of Science	Inclusive mathematics pedagogy, technology and equity	Professional development, virtual simulations and interactive platforms were identified as promising approaches for improving accessibility and engagement.	Teacher professional development and appropriate digital technologies should be integrated into inclusive mathematics education.

16	Sharma & Kumar (2025)	India	Case study	1 adolescent (13-year-old girl) with dyscalculia	Multisensory instruction, cognitive training, accommodations and emotional support	A 12-week individualised intervention was associated with improvements in conceptual clarity, academic preparation and self-confidence.	Indian mathematics classrooms can benefit from individualised, multisensory and emotionally supportive interventions for students with dyscalculia.
17	Akther, Powell & Lariviere (2025)	USA international literature	Research synthesis	17 intervention studies involving preschool/ Kindergarten children with mathematics difficulty or risk	Counting interventions produced moderate-to-strong proximal effects and positive transfer; computer games without instructional strategies alone did not show significant Effects.	Early Mathematics interventions should explicitly teach counting concepts rather than relying only on educational games.	Digital mathematics tools have potential, but their effectiveness should be evaluated through evidence-based and appropriately designed interventions.

Emerging Themes from the Reviewed Literature

After analysing the selected studies, the findings were organised into the following major themes

Theme 1: Universal Design for Learning (UDL)

There is overwhelming evidence that UDL provides multiple ways for students to access mathematical concepts and learning tasks, as well as to demonstrate their understanding of these concepts and tasks. Universal Design for Learning (UDL) is a teaching framework that allows teachers to design lessons that accommodate variability in learners from the outset. UDL promotes lesson planning from a proactive as opposed to a reactive stance.

In mathematics classrooms, UDL can be enacted through:

The use of different representations of mathematical concepts, including diagrams, manipulatives, videos, and digital simulations.

Providing different ways for learners to engage, for example, through games, investigations, and collaborative tasks.

Offering different ways for learners to demonstrate their understanding of mathematics, for example, through oral explanations, models, projects, and/or written work.

Research indicates that UDL increases participation, motivation, and achievement among learners with disabilities.

Theme 2: Differentiated Instruction

There are multiple ways to diversify how you teach students with learning disabilities. One way is to modify the methods you use to teach and assess them. Each of these modifications will hopefully lead to an improvement in students' math achievements. There are many ways to modify teaching methods. One way is to tailor your teaching to students' different levels of readiness, interests, and learning styles. To do this as a math teacher, you can do any of the following:

Offer tasks of different levels of difficulty.

Use flexible grouping.

Offer extra support or scaffolding.

Modify your assessment methods.

Provide different learning materials and resources.

Tomlinson (2017) found that differentiated instruction increases both the engagement and the academic achievements of students in diverse classrooms.

Theme 3: Cooperative and Collaborative Learning

There are multiple benefits to using peer-assisted learning, cooperative group work, and collaborative problem-solving. These teaching methods improve engagement and math reasoning as well as social inclusion. Collaborative learning promotes students' ability to solve math problems and to explain their solutions to their peers. Other benefits include:

Enhanced math communications.

Improved confidence.

Better problem-solving skills.

Improved classroom participation.

Less math anxiety.

Vygotsky's theory supports cooperative learning through peer interaction and scaffolding within the Zone of Proximal Development.

Theme 4: Technology-Enabled Inclusive Mathematics Education

There are many digital tools that can be used to include students in mathematics lessons. Some examples are GeoGebra, Virtual Manipulatives, Interactive Whiteboards, Adaptive Mathematics Software, Educational Apps, and AI Tutoring Systems. The use of technology in the classroom can facilitate individualized learning by providing feedback and adapting learning materials based on the student's needs. Digital tools, virtual manipulatives, educational software, and artificial intelligence can be used to engage students and help them understand math concepts.

Theme 5: Teacher Competence and Professional Development

Teacher knowledge and willingly embracing inclusion, as well as ongoing professional development, are crucial for the establishment of successful inclusive mathematics classrooms.

Theme 6: Curriculum and Assessment Adaptation

Meaningful participation of learners with learning disabilities in mathematics teaching and learning can be facilitated by flexible curriculum, competency-based instruction and formative assessment, and other forms of classroom adjustment.

Use of flexible curriculum and inclusive teaching practices.

Early identification and support of learners with special educational needs.

Reducing curriculum overload to promote conceptual learning.

These reforms create a strong foundation for the formulation of policies that ensure meaningful participation of all learners in mathematics teaching and learning. The requirement of inclusive classrooms is the need for ongoing assessment rather than the sole reliance on the final or end-of-term assessments. Some of the formative assessment strategies include Classroom observation, Exit tickets, Oral questioning, Concept mapping, Peer assessment, Self-assessment, Diagnostic quizzes, Constructive feedback. Hattie (2009) placed feedback in the category of teaching interventions that have a positive impact on student achievement.

Concrete–Representational–Abstract (CRA) Approach

The CRA instructional sequence is one of the most effective interventions for students with dyscalculia. It consists of the following three stages:

Concrete Stage: Learning involves the use of physical objects, such as manipulatives.

Representational Stage: Learning involves the use of diagrams and other visual aids.

Abstract Stage: Learning involves the use of mathematical symbols and equations.

Research has shown that use of the CRA approach leads to an improved understanding of mathematical concepts and retention of the concepts learned.

Multisensory Teaching

It involves the use of visual, auditory, tactile, and kinesthetic experiences, such as using colored place value charts, number cards and flash cards, manipulatives, digital simulations, games, and story-based mathematics.

This approach improves attention, memory, and conceptual understanding for students with learning disabilities.

Theme 7: NEP 2020 and Inclusive Mathematics Education

The analyzed literature shows great overlap between inclusive teaching methods and the visions of NEP 2020 which include equal opportunities, experiential learning, competency-based learning, and the use of ICT to cater to the needs of all learners.

SYNTHESIS OF THE REVIEWED LITERATURE

The reviewed studies show that the use of inclusive teaching methods has a positive impact on the learning of students with learning disabilities in mathematics. No matter what the context of education is, the evidence is clear about the use of differentiated instruction, the use of Universal Design for Learning, collaborative learning, formative assessment, multisensory teaching, and early intervention. The literature shows a shift from framing disability as a learner deficit to framing it as a diversity resource for the mathematics classroom.

Research from India is still lacking. Studies on the implementation of inclusive pedagogies in both public and private schools within the framework of NEP 2020, teacher readiness, the use of ICTs, and learning outcomes in mathematics, are urgently needed. Inclusive, learner-centered teaching improves mathematical learning and participation, as demonstrated by numerous studies. Boaler (2016) documented how flexible learning environments improve understanding of mathematics concepts and lessen anxiety towards mathematics. Florian and Black-Hawkins (2011) contend that inclusive pedagogies make possible full participation of all learners without any form of exclusion. Tomlinson (2017) mentioned that differentiated instruction is able to respond to learner diversity, while UDL increased accessibility through multiple means. Powell and Fuchs (2015), along with Gersten et al. (2009), documented the positive impact of visual aids and explicit instruction on mathematics achievement of learners with learning disabilities. The strategies used in the cited studies call for the urgent adoption of inclusive pedagogies in mathematics education.

National Education Policy (NEP) 2020 and Inclusive Mathematics Education

The inclusion of equity, inclusion, quality, and lifelong learning as central tenets of educational reform in the National Education Policy (NEP) 2020 heralds a new phase in the Indian education system. It affirms that all children, regardless of their social class, ability, language, gender, or location, has the right to education. The policy promotes active learning, diverse pathways and flexible learning, experiential learning, multilingual education, and the integration of technology. All of these strategies support the inclusion of mathematics education.

NEP 2020 recognizes mathematics as a discipline that cultivates logical reasoning, critical thinking, creativity and builds problem solving skills. The policy advocates for a shift from rote memorization to a deeper understanding of concepts through learning by doing, inquiry and experiential learning. Such learning strategies are of great value to students with learning disabilities, as they require learning to happen through concrete experiences, visual aids, structured guidance and continuous feedback.

The key inclusive pedagogy provisions of NEP 2020 are:

Universal access to equitable and inclusive education.

Foundational Literacy and Numeracy (FLN) through the NIPUN Bharat Mission.

Competency-based teaching and assessment.

Activity-based and experiential mathematics learning.

Multilingual teaching to improve conceptual understanding.

Integration of digital technologies and assistive devices.

Continuous Professional Development (CPD) for teachers.

RESEARCH GAPS

The review identifies several important gaps

Insufficient empirical research in India on inclusive mathematics teaching.

Inadequate intervention research focused on dyscalculia.

Inadequate research on the implementation of NEP 2020 in mathematics education.

Inadequate research on the use of AI in mathematics education for children with disabilities.

Inadequate research on long-term impact of teaching mathematics in an inclusive way.

Inadequate research on inclusive assessments in mathematics.

These gaps present opportunities for future research.

RECOMMENDATIONS

In order to improve inclusive mathematics education in India, the following recommendations are given:

Incorporate inclusive pedagogy in both pre-service and in-service teacher education.

Offer Continuous Professional Development on Universal Design for Learning, differentiated instruction and assistive technologies.

Create early screening and intervention programs for mathematics learning disabilities.
Improve the ratio of mathematics manipulatives and digital learning resources.
Foster the use of competency-based and formative assessment frameworks.
Foster school-based collaborative teams that include parents, psychologists, and special educators.
Actively engage mathematics teachers in action research to improve inclusive pedagogy.
Improve funding for research to allow for the investigation of inclusive mathematics teaching and learning, aligned to the NEP 2020.
Create culturally responsive and friendly mathematics resources for multiple languages.
Use AI and educational technology to personalize mathematics learning; focus on equitable access.

CONCLUSION

Incorporating inclusive teaching practices is essential for the advancement of mathematics education towards equity and quality. The literature reviewed in this paper has shown that Universal Design for Learning, differentiated instruction, the Concrete-Representational-Abstract approach, multisensory teaching, cooperative learning, technology-integrated formative assessment, and other practices have positively impacted mathematics understanding, participation, and confidence of learners with learning disabilities. NEP 2020 offers an Opportunity for Indian schools to incorporate these practices through competency-based curricula, experiential learning, and other approaches. Simultaneously, transforming policy into practice will require prior systematic preparation of teachers, adequate infrastructure, identification and early intervention for learning disabilities, inclusive assessment, and collaborative work of all stakeholders. It is important to study the inclusion of pedagogies in mathematics teaching in India, as well as the integration of digital and artificial technologies. This will help create teaching and learning resources tailored to the needs of Indian learners. Ultimately, this will result in mathematics classrooms where all learners are equipped” to participate, achieve, and cultivate the mathematical skills necessary for the 21st century.....

REFERENCES

1. American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). American Psychiatric Publishing.
2. Boaler, J. (2016). Mathematical mindsets: Unleashing students' potential through creative mathematics, inspiring messages and innovative teaching. Jossey-Bass.
3. Butterworth, B., Varma, S., & Laurillard, D. (2011). Dyscalculia: From brain to education. *Science*, 332(6033), 1049–1053.
4. CAST. (2018). Universal Design for Learning guidelines version 2.2. CAST.
5. Faragher, R. M., & Clarke, B. A. (2020). Inclusive practices in the teaching of mathematics: Some findings from research including children with Down syndrome. *Mathematics Education Research Journal*, 32(1), 121–146.
6. Florian, L., & Black-Hawkins, K. (2011). Exploring inclusive pedagogy. *British Educational Research Journal*, 37(5), 813–828.
7. Fornauf, B. S., & Erickson, J. D. (2020). Toward an inclusive pedagogy through Universal Design for Learning in higher education: A review of the literature. *Journal of Postsecondary Education and Disability*, 33(2), 183–199.
8. Gervasoni, A., & Peter-Koop, A. (2020). Inclusive mathematics education. *Mathematics Education Research Journal*, 32(1), 1–4.
9. Government of India. (2016). The Rights of Persons with Disabilities Act, 2016. Ministry of Law and Justice.
10. Government of India. (2020). National Education Policy 2020. Ministry of Education.
11. Hattie, J. (2009). Visible learning: A synthesis of over 800 meta-analyses relating to achievement. Routledge.
12. Lambert, R. (2020). From the margin to the center: A framework for rehumanizing mathematics education for students with dis/abilities. *Journal of Mathematical Behavior*, 58, 100758.
13. Lambert, R., & Tan, P. (2020). Does disability matter in mathematics educational research? A critical comparison of research on students with and without disabilities. *Mathematics Education Research Journal*, 32(1), 5–35.
14. National Council of Educational Research and Training. (2023). National Curriculum Framework for School Education 2023. NCERT.
15. National Council of Teachers of Mathematics. (2014). Principles to actions: Ensuring mathematical success for all. NCTM.

16. Root, J. R., Cox, S. K., Saunders, A., & Gilley, D. (2020). Applying the Universal Design for Learning framework to mathematics instruction for learners with extensive support needs. *Remedial and Special Education*, 41(4), 194–206.
17. Sanger, C. S. (2020). Inclusive pedagogy and Universal Design approaches for diverse learning environments. In C. S. Sanger & N. W. Gleason (Eds.), *Diversity and inclusion in global higher education* (pp. 31–71). Palgrave Macmillan.
18. Tomlinson, C. A. (2017). *How to differentiate instruction in academically diverse classrooms* (3rd ed.). ASCD.
19. UNESCO. (1994). *The Salamanca statement and framework for action on special needs education*. UNESCO.
20. UNESCO. (2020). *Global Education Monitoring Report 2020: Inclusion and education – All means all*. UNESCO.
21. UNICEF. (2021). *Seen, counted, included: Using data to shed light on the well-being of children with disabilities*. UNICEF.
22. Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
23. Yeh, C., Sugita, T., & Tan, P. (2020). Reimagining inclusive spaces for mathematics learning. *Mathematics Teacher: Learning and Teaching PK–12*, 113(9), 708–714.