

Voices of Teachers and Teacher Educators



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About the Journal

Voices of Teachers and Teacher Educators (VTTE), an initiative of the Ministry of Education, erstwhile Ministry of Human Resource Development (MHRD), is a peer-reviewed biannual and bilingual (Hindi and English) online journal published by the NCERT.

The journal highlights the vital role of teacher education in India, as the country is poised to provide quality education to all its children, irrespective of gender, caste, creed, religion, and geography. The National Curriculum Framework for School Education (NCFSE)-2023, National Curriculum Framework for Teacher Education (NCFTE)-2009, Right of Children to Free and Compulsory Education Act (RTE)-2009, and National Education Policy (NEP)-2020—all reflect this commitment, underline the principles that make such an effort necessary, as well as spell out the strategies for it. In this regard, we are faced with challenges that include augmenting the role of teachers in shaping the social transformation India is witnessing of making education equitable and structuring towards a long-lasting impact on the quality of education. Teachers and everyone concerned with education need to recognize that their ownership and voices are important and that they can and do learn not only from their own experiences but also from each other through collective reflection and analysis. The journal attempts to lend voice to students, teachers, teacher educators, researchers, administrators, and policymakers in varied institutions including both academic and administrative structures as well as other stakeholders. The journal aims to facilitate dissemination of their researches and ideas and make their engagement visible in accomplishing the extraordinarily complex and diverse tasks that they perform.

Contributions to the journal are welcome in both English and Hindi. VTTE is published online, and we hope to circulate it widely. The journal seeks to provide a platform and build a network for our voices, ideas, and reflections; it carries articles, research papers, critical reviews, and book reviews and covers several themes in school and teacher education, including best practices, innovations, experiments, and action research.

We look forward to suggestions and comments of our readers on the articles published.

The views expressed and the information given in this journal are those of the authors and may not reflect the views of the NCERT.

Call for Contributions

Invitation for Contributions

We invite you to be part of this collaborative biannual publication designed for the entire educational community—teachers, teacher educators, administrators, researchers, and policymakers. Our journal serves as a dynamic platform to amplify diverse voices, innovative ideas, and thoughtful reflections that shape the landscape of education

Your Voice Matters

To truly represent the richness of our educational community, we welcome contributions that showcase varied experiences, pose critical questions, offer constructive suggestions, and present fresh perspectives on teacher education and schooling practices. We encourage thoughtful analysis and critical discourse on contemporary educational challenges and innovations.

Diverse Formats Welcome

Contributions may take various forms to suit your preferred mode of expression:

- Research articles and analytical reports
- Policy documents and position papers
- Visual narratives through photographs and illustrations

Building a Participatory Community

We also welcome feedback, reflections, and constructive critiques on current and past issues to enhance the quality and relevance of our publication. Your engagement helps transform this journal into a truly participatory endeavor that reflects our collective wisdom and experience.

Submit Your Contributions

Join us in making this journal an authentic representation of educators' voices. We eagerly await your contributions for upcoming issues, along with your valuable comments and suggestions.

Voices of Teachers and Teacher Educators

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Assistance

Ms. Megha Singh Rathore

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Contributors

Vivek Kumar Rawat*, Research Scholar, Department of Education, Indira Gandhi National Tribal University, Email id- ressch.vivek.rawat@igntu.ac.in, ORCID ID- 0009-0003-5828-3736 and **M.T.V. Nagaraju**, Professor, Department of Education, Indira Gandhi National Tribal University, Email id- mtv.nagaraju@igntu.ac.in, ORCID ID- 0000-0002-6505-1234.

K.Thiyagu*, Associate Professor, Department of Education, Central University of Karnataka. Kadaganchi. Aland Road, Kalaburagi, District - 585 367, India., thiyagusuri@gmail.com; thiyagusuri@cukerla.ac.in, thiyagusuri@cuk.ac.in <https://orcid.org/0000-0003-0533-597X>, and **Mary Vineetha Thomas**, <https://orcid.org/0009-0009-5365-1644>, Assistant Professor, Department of Education, Central University of Kerala, Kasaragod District - 671320, India, maryvineetha@cukerala.ac.in.

Fathima Shajeena C.P.*, ORCID ID: <https://orcid.org/0000-0002-3323-8627>, Senior Research Fellow, Department of Education, University of Calicut, Malappuram District, Kerala - 673635, India. Email ID: fathimashajeenacp@uoc.ac.in and **Abdul Gafoor K.** ORCID ID: <https://orcid.org/0000-0002-3907-9954>, Professor & Dean, Department of Education, University of Calicut, Malappuram District, Kerala - 673635, India, Email ID: gfr.abdul@yahoo.co.in.

Tanvi Pahwa*, Research Scholar, Department of Teacher Training & Non-formal Education (IASE), Faculty of Education, Jamia Millia Islamia, New Delhi-110025, Delhi, India. E-mail:drtanvipahwa@gmail.com, ORCID ID: 0009-0006-9435-2630. **Mohd Noor Alam****, Research Scholar, Department of Teacher Training & Non-formal Education (IASE), Faculty of Education, Jamia Millia Islamia, New Delhi-110025, Delhi, India., E-mail: alamnoor.jmi@gmail.com, ORCID ID: 0009-0007-7618-7114. **Aerum Khan*****, Associate Professor, Department of Teacher Training & Non-formal Education (IASE), Faculty of Education, Jamia Millia Islamia, New Delhi-110025, Delhi, India., E-mail: akhan26@jmi.ac.in, ORCID Id: 0000-0002-9846-1440 and **Mohd Faijullah Khan******, Associate Professor, Department of Teacher Training & Non-formal Education (IASE), Faculty of Education, Jamia Millia Islamia, New Delhi-110025, Delhi, India, Email: mkhan44@jmi.ac.in

Krishna Kumar Rajak*, Research Scholar, Department of Teacher Education, Central University of South Bihar, Gaya, India, Email ID - krishna.mjm5@gmail.com, ORCID ID - <https://orcid.org/0000-0002-2235-9263> and **Pragya Gupta**, Assistant Professor, Department of Teacher Education, Central University of South Bihar, Gaya, Bihar. Email ID- pragyagupta@cusb.ac.in.

Niharika Das*, Research Scholar, Department of Education, Tezpur University, Napaam, Tezpur, Assam, India, Dist. Sonitpur, Pin.. 784028, Email id- dasniharika541@gmail.com, ORCID ID: 0009-0005-9333-2657, and **Yeasmin Sultana**, Assistant Professor, Department of Education, Tezpur University Napaam, Tezpur, Assam, India, Dist. Sonitpur, Pin.. 784028, Email id- yeasmin@tezu.ernet.in ORCID ID: 0000-0002-0417-0870.

Paramita Mukherjee *, Ph.D. Research Scholar, Department of Education, Aliah University, Kolkata, India, ORCID ID: <https://orcid.org/0000-0002-2712-3970>, Email- paramita987@gmail.com and **Minara Yeasmin**, Assistant Professor, Department of Education, Aliah University, Kolkata, India. Email- myeasmin047@gmail.com, minara.edu@gmail.com.

Deeptimayee Sagar*, Int. B.Ed.-M.Ed. Student, Department of Teacher Education, Rajendra University, Balangir, District-Balangir, Odisha- 767002, India. Email- deeptisagarrrr@gmail.com and **Prasanta Kumar Nahak**, HOD, Department of Education, A.E.S. Degree College, Tarbha, District- Subarnapur, Odisha -767016, India, E-mail: prasant.nahak123@gmail.com.

Sushil Subham Rout, Research Scholar, (ICSSR Doctoral Fellow), Department of Educational Studies, Faculty of Education, Jamia Millia Islamia, New Delhi. Email id: sushil.subham24@gmail.com

Mukesh Malviya, Teacher , Government Gyanodaya Residential school Narmadapuram Madhya Pradesh , Writer members of NCERT New Textbooks of maths at preparatory stage , Email - mukeshmalviya15@gmail.com

Meghna* , Associate Professor, Department of Resource Management and Design Application, Institute of Home Economics, University of Delhi, F-4, Hauz Khas Enclave, New Delhi-110016, Email : meghna@ihe.du.ac.in, **Pratima Singh**** Associate Professor, Department of Resource Management and Design Application, Institute of Home Economics, University of Delhi, F-4, Hauz Khas Enclave, New Delhi-110016, Email: pratima.singh@ihe.du.ac.in and **Renu Arora*****, Professor, Department of Resource Management and Design Application, Institute of Home Economics, University of Delhi, F-4, Hauz Khas Enclave, New Delhi-110016, Email: renu.arora@ihe.du.ac.in

Vivek Kumar Rawat*, Research Scholar, Department of Education, Indira Gandhi National Tribal University , Email id- ressch.vivek.rawat@igntu.ac.in, ORCID ID- 0009-0003-5828-3736 and **M.T.V. Nagaraju**, Professor, Department of Education,, Indira Gandhi National Tribal University, Email- mtv.nagaraju@igntu.ac.in, ORCID ID -0000-0002-6505-1234

Dashrath Kumar Pareek, Resource Person (Language), University of Rajasthan [RaoRaja Kalyansingh Government College-Sikar), Email- dashrath.pareek@azimpremjifoundation.org

Reviewers

S. No.	Reviewers	Email Id.	Affiliation and Address
1.	Aerum Khan	akhan26@jmi.ac.in	Associate Professor, Department of Teacher Training & Non-Formal Education, Institute of Advanced Studies in Education (IASE), Faculty of Education, Jamia Millia Islamia, New Delhi, India
2.	B. S. Rishikesh	rishikesh@apu.edu.in	Professor, Hub of Education, Law, and Policy, Azim Premji University, Bengaluru, Karnataka, India
3.	Disha Nawani	dishanawani@yahoo.com	Professor, School of Education, Tata Institute of Social Sciences (TISS), Mumbai, Maharashtra, India
4.	Gunjan Sharma	gunjan@aud.ac.in	Associate Professor, School of Education Studies, Dr. B. R. Ambedkar University Delhi, New Delhi, India
5.	Gurjeet Kaur	gurjeet_edu@yahoo.co.in	Professor, Department of Teacher Training & Non-Formal Education, Institute of Advanced Studies in Education (IASE), Faculty of Education, Jamia Millia Islamia, New Delhi, India,
6.	Gurumurthy Kasinathan	guru@itforchange.net	Director, IT for Change, Bengaluru, Karnataka, India
7.	H. K. Dewan	hardy.dewan@gmail.com	Professor (Retd.), Azim Premji University, Bengaluru, Karnataka, India
8.	Jasim Ahmad	jahmad@jmi.ac.in	Professor, Department of Teacher Training & Non-Formal Education (IASE) and Honorary Director, Academy for Professional Development of Urdu Medium Teachers (APDUMT), Jamia Millia Islamia, New Delhi, India.
9.	Jessy Abraham	jabraham@jmi.ac.in	Professor & Head, Department of Teacher Training & Non-Formal Education, Institute of Advanced Studies in Education (IASE) and Dean, Faculty of Education, Jamia Millia Islamia, New Delhi, India

10.	K. Vijayan	kannothvijayan@rediffmail.com	Professor, Department of Curriculum Studies & Development, NCERT, New Delhi, India
11.	M. V. Srinivasan	vadivel.srinivasan@gmail.com	Professor and Head, Publication Division, NCERT, New Delhi, India
12.	Manasi Thapliyal Navani	manasi@aud.ac.in	Assistant Professor, School of Education Studies, Dr. B.R. Ambedkar Ambedkar University Delhi, New Delhi, India
13.	Mythili Ramchand	mythili.ramchand@tiss.edu	Professor & Co-Chairperson, Centre of Excellence in Teacher Education, Tata Institute of Social Sciences (TISS), Mumbai, Maharashtra, India
14.	Nidhi Gulati	nidhi.a.gulati@gmail.com	Professor, Department of Elementary Education, The Institute of Home Economics, University of Delhi, New Delhi, India
15.	Nimrat Kaur	nimrat.kaur@azimpremjifoundation.org	Professor, School of Continuing Education and University Resource Centre (SCE-URC), Azim Premji University, Bengaluru, Karnataka, India
16.	Nisha Butoliya	nisha.butoliya@apu.edu.in	Associate Professor, Azim Premji Foundation, Bengaluru, Karnataka, India
17.	P. K. Basant	prabhatkumar.basant@gmail.com	Professor, Jamia Millia Islamia, New Delhi, India
18.	Preeti Misra	edu.preetimisra@gmail.com	Educator, Udaipur, Rajasthan, India
19.	Rajni Dwivedi	ritudwi@gmail.com	Educator, Tezpur, Assam, India
20.	Ramanujam Meganathan	rama_meganathan@yahoo.com	Professor, Department of Education in Languages & IC Head, International Relations Division, NCERT, New Delhi, India
21.	Ranjana Arora	ranjuarora1967@yahoo.co.in	Professor and Head, Department of Curriculum Studies & Development, NCERT, New Delhi, India
22.	Richa Goswami	goswami84@gmail.com	Educator, Mumbai, Maharashtra, India

23.	Savita Kaushal	skaushal@jmi.ac.in	Professor, Department Of Teacher Training & Non-Formal Education, Institute of Advanced Studies in Education (IASE), Faculty of Education, Jamia Millia Islamia, New Delhi, India.
24.	Sharad Sinha	drsharadsinha@gmail.com	Professor and Head, Department of Teacher Education, NCERT, New Delhi, India
25.	Smriti Sharma	smritionnet@gmail.com	Associate Professor, Department of Elementary Education, Lady Shri Ram College for Women, University of Delhi, Delhi, India

Guidelines for Authors

Scope – ‘Voices of Teachers and Teacher Educators’ primarily gives space to contributions including empirical researches, studies, policy analysis, personal or institutional experiences, perspectives, book reviews as well as critical commentaries on various aspects in the field of school and teacher education such as teaching-learning, schooling systems, pre-service and in-service teacher education.

The submissions should be original, unpublished work of the author(s) that highlight the contribution of the author(s) in the field of study. It is essential that the empirical studies are situated in robust conceptual frames and offer insights into the issues and analysis of data whether qualitative or quantitative. The manuscript must not be a mere exercise in applying statistical methods to collected data without foregrounding the same in meaningful research questions. Essay type manuscripts that merely list sub-topics or issues in bullet points will not be accepted.

Ideas developed in the text must be clear and coherent; the argumentation must be convincing. The paper must be clear and bring out the points examined in the text so that the reader can have a clear idea of the author’s(s’) perspective.

Format - The typical length of an article can be from 2500 words but it should not exceed 7000 words including references and appendices. The manuscript must include title, author details, abstract, keywords, well-defined sections and subsections (as applicable for the manuscript type), and proper referencing. (While there is no lower limit, the contribution must not be merely an exposition of a point of view or an uncritical / hypercritical presentation of an experience). The author details must include author **name (including professional title), ORCID (if any), designation, affiliation (including department, institute/university/college/school/organisation name, district, town/city, state, pincode, and country),** and **e-mail address**. Names of departments and institutes/universities/colleges/schools/organisations must be included in their expanded forms, followed by their acronyms (if any) in parentheses.

The manuscript should be written in Times New Roman 12 Font or in Unicode (for Hindi) with double spacing. Submit a word file with shortened manuscript title as the filename.

The authors must ensure that all figures and tables are neatly and consistently aligned and that each figure and table is labelled and captioned. For example- “Figure 1: Distribution of students across various disciplines”. The description of the figure and the label would be below the figure and for the table above the table.

Language - Author(s) need to ensure that the manuscripts are written in clear, coherent, and **grammatically correct** language (English (UK) or Hindi, as applicable). The author(s) must thoroughly proofread their work for language, spelling, punctuation, grammar, and syntax. The language of the text should not be full of jargon or with gymnastics of technical words. It should be purposeful, relevant, and understandable for the audience of the journal.. Nuances such as apt capitalisation for manuscripts in English as well as usage of proper symbols must be duly addressed. Refer to APA 7th-edition guidelines for further details on best practices in academic writing in English (<https://apastyle.apa.org/>).

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The authors must include articles and texts that are directly relevant to their study and refrain from using tangential or indirect references. An unnecessary long list of references doesn't add value to the manuscript, rather it is distracting.

Plagiarism - As per the policy 'Voices of Teachers and Teachers Educators', contributions with a similarity index higher than 10% on Turnitin would not be considered for review. Author(s) are encouraged to check the similarity index using online mechanisms before submitting the manuscript.

When citing other authors' work or their own work, it needs to be ensured that long quotes or too many quotes are not cited in the manuscript. The contents of the paper should be an interpretation of the cited work, **in the words of the author(s)**. Credit must be given for the work referred to and if it is central to your paper you can make its essence available, but it cannot be through the use of text from the work as it is. The author(s) are also urged to undertake the Plag test for their submission if possible and attach the report so that the process of review is quicker.

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The revisions in response to comments from the reviewer (including those added by the reviewer in the document) must be highlighted or indicated in a different colour. Alternatively, the author(s) may use the Track Changes or the Google Edit mode or colour code the changes for revision. However, the comments and tracks must not display the name of the author(s) and must not reveal the full identity of the author(s) in any way.

To expedite the re-review process, authors are requested to send an additional file containing a table of responses listing all comments from the reviewer and the corresponding responses of the author(s) to those comments in highlighted form.

The authors must appropriately name the files that they send. For a new submission, a shortened manuscript title may be used as the filename; for revisions, the same title may be suffixed with a "revised", "revised_2", and so on for subsequent revisions. Any separate files containing responses to reviewer comments may be named as relevant. For example: "Table of Responses_<Brief Manuscript Title>".

To ensure seamless communication between the authors and the VTTE Team, the author(s) is(are) requested to restrict all future correspondences regarding their manuscript within the original mail thread for the manuscript and not begin/use a different subject line/mail thread for any emails pertaining to the manuscript.

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Editorial

This is the second issue of the Voices of Teachers and Teacher Educators' for the year 2025. In this issue, we have included 13 articles from a variety of institutions and covering a range of issues and contexts that reflect the breadth of work happening in the field.

Voices of Teachers and Teacher Educators were initiated to create a place where practitioners on the ground would present reflections on the work that they are doing. In this presentation they may draw on some systematic study that they have undertaken or develop arguments based on their professional experience. The purpose of this was to bring to the fore the work being done at the ground, the successes and their challenges. It was also believed that carefully crafted and thought through publication will introduce the readers to materials that will be relevant and interesting for them. This of course would be done through carefully written reviews of books which are meant to have dialogue with the teachers.

Apart from this the publication had another aim. This aim was to provide a platform for young researchers and field practitioners (both teacher educators and teachers) to present their work based on their attempt to address some of the things that they had observed, felt and were concerned about. The idea on the one hand, was to help promote research in education in the institutes of education and teacher training colleges while on the other hand, to help anyone working in education who wanted to study a phenomenon or wants to try to find a response to any situation that concerns them.

We get a lot of submissions and very often we have to reluctantly inform the authors that the work they have submitted is not suitable for this publication. We are therefore restating the purpose and the kind of work we would publish in VTTE.

We would like to have more submissions of the kind that are suitable for the purposes of this publication which was started to fill a gap in existing journals and provide a platform for practitioners. The purpose of the publication is to generate new understanding from the experiences, reflections or specifically collected data from their contexts. The understanding is that while the analysis along with the evidence need not follow a framework that addresses all aspects of research, it yet has to bring something new to the understanding of the person who is reading it and also to the person who has written the paper. Such reflections need to have a basis in the work that the author is working on and has an interest in. They must arise from genuine questions or concerns or insights that the author wants to study for himself/herself. The data collected and the analysis should present relevant insight. Given the purpose of Voices of Teachers and Teacher Educators it is expected that the work presented is not merely an exercise in mathematical and statistical analysis. It must have some educational implications not in the sense of recommendations about what to do but more in the sense of how it can help us understand the reality better. We would like to point out that there are many articles that come to us which have very little educational or conceptual content. These papers which may have large quantitative data and perhaps very complicated statistical analysis are not relevant for this publication because the audience for this is not very specialized researchers who would benefit from specific narrow studies which are in the context of some other work. In this sense, this publication should not be looked upon as simply a research journal in which any article may be considered but rather as a 'voice' that foregrounds practitioner knowledge and lived experiences. We would also like to remind our readers and potential authors that the publication is focused on preschool

and school education as well as teacher education. We do not carry articles about higher education. There are other forums where articles on higher education can be published.

Given the nature of the authors we want to encourage writing for us, the size of papers can be very varied. Ideally we would like the articles to be in the range of 3000 to 5000 words but we can carry pieces of suitable work which are even as small as 2000 words or as big as having 7000 to 8000 words. We will generally not publish articles beyond this 8000 word limit unless there is some exceptional justification for it.

The publication is bilingual and that means you could send in your work in either Hindi or English. We have a strict policy on the use of AI and for plagiarism. As authors we must remember to ensure that we do not pick up material from other work even if it is your own or quote without proper citation. Our editorial policy does not encourage authors to include long quotes from other work. The policy of the publication does not expect you to use any AI models to help you with your writing. All these points are also listed in the note to the authors intending to write. The last thing we would like to point out is that we have a rigorous process of blind review that also provides feedback to the authors in order to help them modify their work. All this takes time therefore and sometimes the gap between submission and publication can be quite long. And now let us come to the articles in this issue.

This second issue for this year 2025 includes 13 articles from a variety of authors, on diverse themes and from different kinds of contexts. The articles represent a small part of the variety of work that is presently happening in India. There are 6 papers that are related to teachers, their preparation and their insights about different aspects of education.

The first of these papers ‘An Analytical Study of Teachers’ Insights on the Integration of Ethnocultural Perspectives in Indian Education’ has been written by Vivek Kumar Rawat and M.T.V. Nagaraju. The paper is based on the study of the perceptions of secondary school teachers regarding their use of inclusive pedagogy and cultural responsiveness in order to promote ethnocultural inclusion. The study included the use of cultural symbols and communal knowledge in an educational setting of a homogeneous classroom environment.

The second paper by K. Thiyagu and Mary Vineetha Thomas is titled ‘Digital Gamified Learning in Teacher Education: Insights from Pre-service Teachers in Kasaragod District’. is based on a descriptive survey of the awareness, experiences, and perceptions of the pre-service teachers about DG.

The third paper is a study entitled ‘Strengthening Self-regulated Learning in Teacher Education: An Analysis of Policy Alignment and Curriculum Integration’ authored by Fathima Shajeena CP and K. Abdul Gafoor. This study reviews post-2005 experimental interventions on student-teacher self-regulated learning skills (Metacognition, Self-efficacy, Self-monitoring, Motivation, and Self-directed Learning) and seven core strategies (Task-analysis, Reflective practices, Self-assessment, Collaborative learning, Feedback, Planning, and Problem-solving).

The fourth paper by Tanvi Pahwa, Mohd Noor Alam, Aerum Khan and Mohd Faijullah Khan, has the title ‘Twice-Exceptionality (2e): A Perspective of Pre-Service and In-Service Special Educators’ studies the awareness of pre-service and in-service special educators about learners who have high intellectual abilities but some specific learning challenges or disabilities that calls for specialized attention in educational settings.

The fifth paper related to teachers is entitled ‘Are Tomorrow’s Teachers Ready: Assessing Prospective Teachers’ Competency in Implementing Universal Design for Learning in the Classroom’ submitted by Krishna Kumar Rajak and Pragya Gupta. The paper examines the implementation of Universal Design for Learning by prospective teachers. The study found

that prospective teachers were enthusiastic about UDL practices which emphasize hands-on practice important for diverse classrooms.

The sixth and the last paper related to teachers are about supervision and feedback during internship. The title of the paper is 'Supervision That Speaks: Understanding Feedback Practices during School Internship' and is presented by Niharika Das and Yeasmin Sultana. This study investigates the nature and frequency of interactions between supervisors and student teachers before, during, and after classroom teaching sessions. The study indicates that the effectiveness of the supervisory feedback is largely dependent on its clarity, timeliness, relevance, and the nature of the interaction between the supervisor and the student teachers.

There are five papers that are linked to the schools from different contexts that are studying different dimensions. The first paper by Paramita Mukherjee and Minara Yeasmin studies the 'Awareness of Reproductive Health among Adolescents in Schools under the CBSE Curriculum in Kolkata'. The paper tries to understand the knowledge of adolescents about their reproductive health and what the impact of reproductive health issues on their well-being is. The study finds that adolescents struggle to access trustworthy sources of information and lack adequate awareness of reproductive health.

The second paper has the title 'Factors Affecting Student Absenteeism in Rural Elementary Schools of Kalahandi District of Odisha' by Deeptimayee Sagar and Prasanta Kumar Nahak. This paper studies student absenteeism and explores factors related to it including measures taken by stakeholder in rural elementary schools of migration-prone Golamunda block in Kalahandi district.

The next paper in this area has the title 'English Medium Instruction (EMI) in Odisha Adarsha Vidyalayas (OAVs) Policies, Practices, and Promise of Quality Education'. Written by Sushil Subham Rout, the paper argues that in the districts of Mayurbhanj and Cuttack in Odisha, India English medium education rather than providing upward mobility, it frequently aggravates the pre-existing educational disparities.

The fourth paper related to school is a reflection based on his work by Mukesh Malviya. The title of the paper is 'गणित में समस्याओं से जूझने का आनंद' (The joy of engaging and struggling with problems in Mathematics). The author presents an analysis of the experience of exploring some number patterns and trying to find answers to questions that are new for them. The author argues that mathematics classrooms need to take 'risks' and engage with unusual problems in different ways. This would also be enjoyable for the students as well as the teacher.

The last paper in this is 'Effects of Prolonged Sitting in Schools on Musculoskeletal Health of School Children in Delhi' written by Meghna, Renu Arora and Pratima Singh. This is an interesting study that explores the effect of prolonged hours of sitting, including static posture, in school. The study finds that this puts a lot of physical stress on the muscles and ligaments and many school children experience body pain caused by some awkward postures that have to be maintained during long hours of classroom activities.

The next paper by Vivek Kumar Rawat and M.T.V. Nagaraju is about how to relate mathematics to culture and has the title 'A Study of Mathematical Patterns and Cultural Symmetry in Traditional Weaving, Beadwork, and Basketry'. This paper explores the geometrical structures present as tessellations and symmetry in different crafts and the fundamental concepts like permutations, combinations, tessellations, and geometric transformations underlying them.

The last inclusion in the issue is the review of the book in hindi. The review is by Dashrath Kumar Pareek of the book The foundational ideas of Language: A collections (भाषा का बुनियादी ताना-बाना : एक संकलन). The book is an edited volume by Rajni Dwivedi and Hriday Kant Dewan. The reviewer suggests that the volume is an essential read for those thinking of working in education of young children to build an understanding of language and its process of acquisition and learning.

We look forward to your comments on the papers included in this issue and your contributions for the future issues. We have two issues in a year and try to make all the efforts to include the paper in the earliest issue but it depends on the extent to which the paper meets the requirements of Voices of Teachers and Teacher Educators. We are thankful to the contributors for their effort and their patience in responding to the reviewer comments. And of course we are extremely thankful to the reviewers who make an effort to give comments and feedback quickly and sometimes many times for one paper.

An Analytical Study of Teachers' Insights on the Integration of Ethnocultural Perspectives in Indian Education

Vivek Kumar Rawat *, M.T.V. Nagaraju

Abstract

The study was being undertaken among secondary school teachers regarding their perception of ethnocultural inclusion with special focus on inclusive pedagogy and cultural responsiveness. As India is a diverse socio-cultural country, the research focused on how teachers in an educational setting use cultural symbols and communal knowledge as part of their teaching in a homogeneous classroom environment. A descriptive survey design has been employed, and data collected on 168 teachers working in government and private schools of Patna district, Bihar. The cohort of participants was ethnically diverse and covered the fields of gender, school system, and subject area. The Perception Scale on Ethnocultural Practices (PSEP), a researcher-designed scale with 18 items that are structured into three dimensions – Understanding of Ethnocultural Perspective, Perception of Pedagogical Approaches, and Personal Engagement with Ethnocultural Perspectives – was utilized. An acceptable reliability coefficient (Cronbach's alpha = 0.755) was produced by estimates of internal consistency. The results of the analysis showed significant disparities in ethnocultural perception with gender, type of school, and stream of teaching. In such a way, the study focuses on the necessity of special programmes of professional development, curriculum reform, and culturally relevant teacher education in order to reduce perception deficits and foster fair educational settings. The potential of integrating the ethnocultural views is especially strong concerning inclusive schooling that is identity-affirming, especially among students who belong to historically marginalized populations. These results have policy, teacher-training, and teaching-curriculum implications in the pluralistic setting in education.

Keywords: Ethnocultural Perspectives, Indian Education, Pedagogical Practices.

Introduction

Ethnocultural perspectives on the approaches of teaching have a critical role in the multifaceted Indian landscape of education (Wahab et al., 2018). Classes comprising a tandem of ethnical backgrounds and cultural narratives are becoming more and more prevalent, and educators are beginning to understand the necessity for teaching that is now sensitive to it, but at

the same time, proactive about it (López & Malfa, 2020). Hence, this realization emphasizes why intercultural education is not only a beneficial but an essential part of the inclusive learning environment. Thus, pedagogy is transforming itself into spaces in which learning is based on the context of the students' own cultural experiences. This method promotes learning that is interesting and meaningful since it happens in environments where students feel most

comfortable and considers the ways they naturally understand the world.

According to D. Quiao et al. (2024), “Ethnocultural perspective is an educational design that makes clear identification, synthesis, and appreciation of the cultural, ethnic, and linguistic background of learners in every aspect of teaching and learning. This prism is not profane at its surface; it puts the culturally responsive pedagogy, democratic ability of participation, and acknowledging students’ lived realities in the foreground (Ortikov, 2021; Ladson-Billings, 1995). In classrooms, such an approach is realized with the inclusion of local cultural content into textbooks, with the adoption of mother tongue or regional idioms as teaching devices, and the development of assessment protocols that reflect community-based systems of knowledge.

Outside India, empirical research studies have revealed that an ethnocultural practice can improve student participation, performance, and identity formation. In New Zealand, Māori oral narratives play an important role in that the Māori oral narrative is at the heart of early childhood education (Ritchie & Rau, 2006). In Alaska, Indigenous ecological knowledge is embedded in the

science curriculum (Barnhardt & Oscar Kawagley, 2005). However, in the Indian case, the assimilation of ethnocultural insights into mainstream education is still relegated to the periphery due to inflexibility in curricular planning, lack of teacher preparation, and poor policy formulation.

Additionally, teachers can find out a far more meaningful level of engagement and involvement by centering students’ life history and personal experiences (Figueredo-Canosa et al., 2020). Honoring the individuality of each learner is so important, and it is what these student-centric teaching approaches do, which allows a deeper learning experience (Chiner et al., 2015).

This research involves the investigation of the perceptions that the Indian school teachers have towards the ethnocultural practices and how much they affect their pedagogical choices. The research will utilize a formalized perception scale completed by a non-homogenous sample of teachers to outline the existing degree of awareness levels, establish gender-based and stream-based differences, and determine the role of school type in teacher willingness to include ethnocultural aspects in their own classrooms.

Examples of Ethnocultural Perspective in Educational Settings



Figure:1 Traditional play ‘Jamuran’ is a character-building media among students (Source: Sakti et al., 2024)



Figure 2: Students visiting a traditional market to enhance local community enhancement in character education among students (Source: Sakti et al. 2024)



Figure 3 The modern Seega game (Source: Fouze and Amit, 2017)

Ethnocultural Perspective Used in the Classroom

Curriculum Adaptation: At the level of curriculum, a teacher redesigns the textbook and other teaching materials strategically by blending in contextual narrative, symbols, and examples that appeal to the local community of learners to create a sense of meaning and connection to their local culture.

Culturally Responsive Teaching: The didactic sequence itself is constructed in a way that confirms the linguistic and cultural identity of students; proverbs, idioms, and narratives that are extracted from regional traditions are applicable as explanation tools and the main concepts.

Inclusive Assessment: Evaluation procedures and practices are not limited to standard examinations and include knowledge delivery methods (e.g., oral folklore, cultural display, and group collaborations), hence making it possible to access a wide variety of learning with the evaluations.

Community Engagement: Educators collaborate with adults, community artisans, and parents in order to co-create learning experiences, such as bringing in a member of a local tribe who weaves to explain concepts around symmetry and pattern making as part of a mathematics unit.

Significance of the Study

Understanding ethnocultural diversity in educational settings is not a matter of conforming to political correctness (Kansal et al., 2022). Rather, it honours differences and is a direct source of increasing student learning outcomes. Culture-based education strategies are proven to increase the academic success of those traditionally disadvantaged, particularly the labour group who have endured educational inequalities because of a misfit with the dominant culture (Kansal et al., 2022). Culture-based curriculum and teaching methods incorporated by educators are more inclusive to all students because they value and acknowledge the cultural uniqueness of all students (Koptseva et al., 2011). Equity and social justice can be promoted through this approach, which also helps develop a sense of belongingness and engagement among students, which can ultimately lead to better academic achievement (Ortikov, 2021). Addressing the education inequalities based on caste and ethnicity that are found in Indian society, students from all backgrounds are given the opportunity to become academically successful. By doing so, educators not only help reduce the gap of educational disparity, but they also take part in the preservation of ethnic cultures, which is more and more significant in the diverse and connected world of today.

Statement of the Problem

The research paper titled 'An Analytical Study of Teachers' Insight on the Integration of Ethnocultural Perspectives in Indian Education,' which conceptualises the relevance of cultural diversity in the Indian education system, is analysed. The study stresses the necessity for culturally sensitive teaching styles that recognize and appreciate the various cultural backgrounds of all students.

Literature Review

Kansal et al. (2022) analyzed the cross-cultural barriers of students of the Indian subcontinent and the methods of understanding and approaching obstacles by the university staff. Their findings emphasized the necessity of adopting culturally responsive approaches in educational institutions to enhance the level of inclusion, as well as engagement of the students. The paper argues that not only is recognizing ethnocultural diversity beneficial in improving academic achievements, but it is also countering systematic disparity. The results, therefore, provide evidence to show the assertion that the inclusion of ethnocultural points of view is fundamental to inclusive pedagogic practice in diverse societies.

Sinha (2024) explored how cultural diversity affects the primary-school teachers in India. Communication barriers and cultural misunderstandings are also mentioned in the research as major hindrances to classroom communication and impediments to learning. However, the discussion shows that promoting intercultural knowledge may foster student performance and help to promote societal integration.

Parveen an Ansari (2022) examine the general attitude of Indian teachers towards cultural diversity in educational practice. The research indicates a general understanding by teaching faculty of the necessity to consider ethnocultural

awareness during the planning of instruction. This evidence gives the indication that there is a growing agreement amongst academicians that ethnocultural competence is necessary for the delivery of equitable, context-relevant learning conditions. On this basis, the author suggests that behavioral perceptions of teachers play a central role in promoting inclusive learning contexts.

Sarangapani (2021) views comparative education study in India as essential and indicates that it must be serious, as it improves cultural lenses into teacher preparation and instruction procedures. The author believes that professional development needs to help educators foster an ethnocultural sensitivity so that they can accommodate versatile learner communities within the country, in their service. This argument is supported by the current research, which shows that there are differences across disciplines in terms of ethnocultural perception, especially among social science educators.

Pradhan (2015) defines culturally relevant pedagogy as a paradigm that is supposed to establish inclusivity and equity in schools. It is argued in the study that reform to align and match curriculum and instructional practices by bringing a sense of students' cultural identities can build a more accommodating learning environment. The author claims that this type of pedagogy supports the feelings of respect and understanding held by the students, which are both highly considered critical to success in academia.

Hariyadi and Rodiyah (2023) evaluated the gendered differences in the perception of multicultural education among the teachers and their attitude to the values of diversity. Their findings recorded high levels of differences: male teachers exhibited improved levels of cultural responsiveness, whose results the authors linked to different training or exposure.

Figueredo-Canosa et al. (2020) looked at how teachers perceived intercultural

education and how teacher training is a key aspect of enhancing cultural sensitivity among them. These results show that teachers who have been adequately equipped with intercultural elements are more likely to use inclusive classroom practices. The authors thus emphasize systemic professional development as an instrument to increase cultural competence.

Chiner et al. (2015) study examines the perceptions of teaching professionals in relation to diversity as well as how their individual and professional experiences are associated with the field of inclusive teaching. The results show that culturally aware persons create more engagement among students by applying the concept of diverse identities of learners.

Objectives of the Study

1. To find out the level of awareness among teachers on the integration of ethnocultural perspective in Indian education.
2. To study the teachers' awareness of ethnocultural practices in educational settings with respect to their demographic variables.

Hypotheses of the Study

1. There will be no significant difference between the level of awareness among teachers on the integration of the ethnopedagogical perspective in Indian education.
2. There will be no significant difference between male and female with regard to overall teachers' awareness of ethnocultural practices.
3. There will be no significant difference between the types of schools with regard to overall teachers' awareness of ethnocultural practices.
4. There will be no significant difference between their streams with regard to overall teachers' awareness of ethnocultural practices.

Methodology

This study employed a descriptive survey design to investigate school teachers' awareness of ethnocultural perspectives in Indian education. A descriptive approach was deemed appropriate for exploring existing attitudes, awareness, and practices among teachers regarding ethnocultural inclusivity within the school environment.

Population and Sample

The target population for the study comprised school teachers from Patna District, Bihar, teaching at the secondary level. A purposive sampling technique was used to select 168 teachers representing diverse institutional backgrounds, including Patna Central School, Kendriya Vidyalaya Sangathan (KVS), and Navodaya Vidyalaya Samiti (NVS). The sample was balanced across variables such as:

- Gender: 86 male, 82 female
- Area: Urban (59), Semi-Urban (64), Rural (45)
- Stream: Physical Science (42), Biological Science (60), and Social Science (66)
- School Type: Government (90 teachers) and private (70 teachers)

Tools Used

To collect data, the researchers developed a structured instrument titled 'Perception Scale on Ethnocultural Practices' (PSEP). The tool was specifically designed to capture the perception of teachers on how ethnocultural elements are recognized, practised, and valued in classroom settings.

The scale comprised 18 items, covering three key dimensions:

1. Understanding of Ethnocultural Perspectives
2. Perception of Pedagogical Practices
3. Personal Engagement with Ethnocultural Elements

The tool was validated through expert consultation, and language adjustments were made to ensure contextual relevance.

Reliability

The internal consistency of the scale was tested using Cronbach's Alpha, which yielded a reliability coefficient of 0.755, indicating acceptable reliability for attitudinal research instruments.

Result and Discussion

Objective 1: To find out the level of awareness among teachers on the integration of ethnocultural perspective in Indian education.

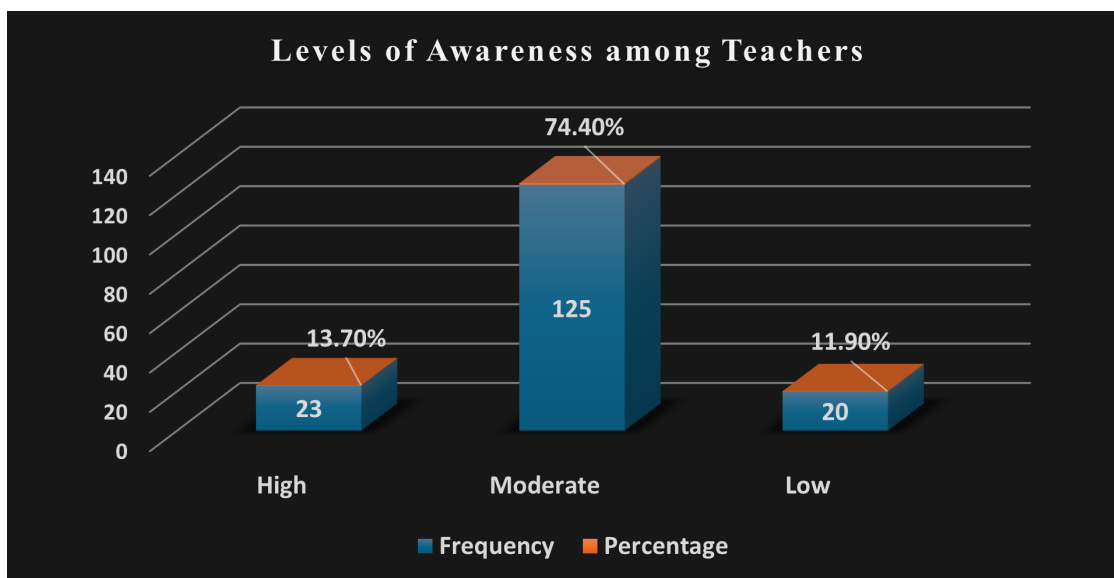


Figure 4: Levels of awareness of teachers on the integration of ethnocultural perspective in Indian education

Figure 4 shows the level-wise distribution of teachers' awareness, with the majority of the respondents lying within the moderate to high levels regarding their awareness of the integration of ethnocultural perspectives in education. This implies that although most teachers exhibit a relatively good understanding and appreciation for cultural diversity, there is still a proportion with a low awareness

level, a phenomenon that continues pointing to the need for professional development and sensitization towards teaching inclusively and culturally responsively.

Hypothesis 1: There will be no significant difference between the level of awareness among teachers and the integration of the ethnopedagogical perspective in Indian education.

Table 1: ANOVA for significant differences among the level of awareness among teachers and the integration of ethnocultural perspective

	Sum of Squares	df	Mean Square	F	Sig.	Inference
Between Groups	2054.358	2	1027.179	201.216	.000	Significant
Within Groups	842.302	165	5.105			
Total	2896.661	167				

*Denotes significant at 0.05 level

Table 2: Difference in the level of awareness among teachers, Post-Hoc Test

Factors(I)	Factors(J)	Mean Difference (I-J)	Sig.	Inference
High	Moderate	5.870	.000	Significant
	Low	13.824	.000	Significant
Moderate	High	-5.870	.000	Significant
	Low	7.954	.000	Significant
Low	High	-13.824	.000	Significant
	Moderate	-7.954	.000	Significant

The results of the one-way ANOVA ($F(2,165) = 201.216, p = .000$) prove that there is a significant difference in how teachers use ethnopedagogical approaches according to their levels of awareness. In addition, it is shown that teachers who have higher awareness put ethnopedagogical practices to use more than teachers who score moderately or low on awareness. It is similar to the findings from (Chiner et al., 2015; Figueredo-Canosa et al., 2020), which suggest that being aware of cultural issues encourages teachers to address students' differences. It argues that a teacher's view

of the subject plays a big role in applying ethnocultural awareness in the classroom. The study also agrees with Sarangapani (2021), who suggests that professional development helps teachers become culturally competent and adapt to different teaching situations. Thus, teachers should have a better understanding of ethnocultural issues to make education more inclusive in India.

Hypothesis 2: There will be no significant difference between male and female with regard to overall teachers' awareness of ethnocultural practices.

Table 3: Factors of ethnocultural perspectives with respect to gender

Factors of Ethnocultural Perspectives	Gender				t value	P value	Remarks
	Male		Female				
	Mean	SD	Mean	SD			
Understanding of Ethnocultural perspectives	11.07	1.807	10.37	1.703	2.595	.010*	Significant
Perception of pedagogical practices	11.41	1.745	10.32	2.319	3.452	.001*	Significant
Personal engagement with ethnocultural perspectives	12.12	1.718	10.98	2.272	3.682	.000**	Significant
Overall awareness of ethnocultural practices	34.59	3.050	31.66	4.641	4.865	.000**	Significant

*Denotes significant at 0.05 level

**Denotes significant at 0.01 level

Table 3 shows the results of a gender-wise comparison of teachers' awareness, finding that scores for male teachers were significantly higher than those of female teachers in all domains of understanding of ethnocultural

perspectives, pedagogical practices, and personal engagement. These results that are significant at the 0.05 and 0.01 levels indicate the fact that gender is a significant variable in determining teachers' cultural responsiveness.

The results reject the null hypothesis and speak of substantial distinctions in all aspects of ethnocultural perception along gender lines. There was a uniform superiority in all factors exhibited by male teachers. The significant gender-based differences suggest that male teachers may have greater exposure to cross-cultural classroom situations, more confidence in managing diversity, or increased participation in professional development

programmes. This finding aligns with Hariyadi and Rodiyah (2023), who highlight the need for gender-balanced training in multicultural pedagogical skills. Addressing this gap through gender-sensitive teacher education can ensure equitable application of ethnocultural practices.

Hypothesis 3: There will be no significant difference between the types of schools with regard to overall teachers' awareness of ethnocultural practices.

Table 4: Factors of ethnocultural perspectives with respect to types of school

Factors of Ethnocultural Perspectives	Types of School				t value	P value	Remarks
	Government		Private				
	Mean	SD	Mean	SD			
Understanding of Ethnocultural perspectives	10.82	1.790	10.60	1.789	.773	.441	Not Significant
Perception of pedagogical practices	11.21	1.938	10.40	2.261	2.503	.013*	Significant
Personal engagement with ethnocultural perspectives	11.84	1.774	11.17	2.408	2.062	.041*	Significant
Overall awareness of ethnocultural practices	33.87	3.379	32.17	4.923	2.649	.009*	Significant

*Denotes significant at 0.05 level

Table 4 shows the comparison of teachers' perceptions from government and private schools on the factors of ethnocultural perspectives. The findings show that pedagogical practices, personal engagement, and overall perception by government school teachers' scores were significantly higher, at a significance level of 0.05, while the difference for understanding ethnocultural perspectives was not significant. This signals a better alignment with inclusive practices in public education settings.

This analysis shows that teachers in government schools have a remarkably higher sense of perception regarding ethnocultural practices as opposed to teachers in private schools, therefore rejecting the null hypothesis. The significant differences between government and private

school teachers indicate that public school educators may be more routinely exposed to students from tribal, linguistic, and caste-diverse backgrounds. Government schools often follow inclusive education policies more rigorously, including the use of regional languages, resource teachers, and community-based curriculum content. On the other hand, private schools may focus more on standardized curricula with less flexibility for local cultural integration. This echoes the findings of Ortikov (2021) and Subasi Singh and Akar (2021), who noted that socioculturally diverse contexts tend to demand more responsive pedagogy.

Hypothesis 4: There will be no significant difference between their streams with regard to overall teachers' perception of ethnocultural practices.

Table 5: ANOVA for significant differences among teachers' awareness with respect to the factors of ethnocultural perspectives

		Sum of Squares	df	Mean Square	F	Sig.	Inference
Understanding of ethnocultural perspective	Between Groups	16.392	2	8.196	2.616	.076	Not Significant
	Within Groups	517.012	165	3.133			
	Total	533.405	167				
Perception of pedagogical practices	Between Groups	29.607	2	14.803	3.417	.035*	Significant
	Within Groups	714.768	165	4.332			
	Total	744.375	167				
Personal engagement with ethnocultural perspectives	Between Groups	39.760	2	19.880	4.798	.009*	Significant
	Within Groups	683.644	165	4.143			
	Total	723.405	167				
Overall awareness of ethnocultural perspectives	Between Groups	249.317	2	124.658	7.770	.001*	Significant
	Within Groups	2647.344	165	16.045			
	Total	2896.661	167				

*Denotes significant at 0.05 level

Table 5 examines awareness of teachers based on their subject streams using ANOVA. The understanding of ethnocultural perspectives showed no significant difference ($p = .076$), but differences

regarding pedagogical practices, personal engagement, and awareness (overall) were significant ($p < .05$), illustrating how subject discipline might affect the ethnocultural sensitivity.

Table 6: Difference in factors of overall perception of teachers, post-hoc test

Dependent Variable	(I) Stream	(J) Stream	Mean Difference	Sig.	Inference
Overall Awareness	Physical Science	Biological Science	-.714	.650	Not Significant
		Social Science	-2.851*	.001	Significant
	Biological Science	Physical Science	.714	.650	Not Significant
		Social Science	-2.136*	.009	Significant
	Social Science	Physical Science	2.851*	.001	Significant
		Biological Science	2.136*	.009	Significant

Table 6 provides the post-hoc comparison between the subject streams and demonstrates that social science teachers differ significantly with regard to overall ethnocultural perception from those of physical and biological sciences. The differences are statistically significant ($p = .001$ and $p = .009$, respectively), confirming the fact that the pedagogical environment's cultural diversity is perceived by social science educators more than it is perceived by those who teach other disciplines.

The statistically significant differences in awareness across subject streams reveal that social science teachers are naturally more engaged with ethnocultural themes. Their curriculum inherently involves discussions of history, society, identity, and diversity, making it easier to integrate culturally relevant examples. In contrast, science and mathematics teachers may struggle to see the immediate connection between their content and cultural contexts, unless they are explicitly trained to embed indigenous

knowledge or local examples. Sarangapani (2021) suggests that teacher education in India often lacks interdisciplinary ethnocultural content, leading to subject-based disparities in implementation.

Major Findings

According to the study, extreme variation in the awareness of ethnocultural integration of teachers is found under differentiation by gender, the type of school, and academic discipline. There was a significant difference in the overall awareness between male and female teachers with male teachers having higher overall awareness than female teachers, particularly in understanding, pedagogical implementation as well as personal engagement with the ethnocultural perspectives, implying a gender difference in cultural responsiveness (Hariyadi & Rodiyah, 2023). The teachers in government schools were more receptive to ethnocultural practices, as compared to the private schools, probably because they had more contact with culturally diverse students (Kansal et al., 2022). Moreover, social science teachers claimed a more profound understanding and association with the ethnocultural modes of teaching in contrast to physical and biological sciences teachers, which signifies that the context and sociocultural make-up are the inherent features of their subject matter (Sarangapani, 2021; Pradhan, 2015). These results reaffirm the inequality in the Indian teaching community with regard to the distribution of ethnocultural awareness and the need for a more comprehensive professional training that breaks the boundaries of disciplines and institutions.

Educational Implications and Suggestions

Based on the findings and interpretation of this study, the following suggestions are offered for enhancing the integration of ethnocultural perspectives in Indian school education:

Targeted Training for STEM Teachers

Since social science and language teachers showed a higher level of ethnocultural awareness and integration (Hypothesis 4), subject-specific capacity-building programmes should be designed for science and mathematics teachers. Workshops should demonstrate how ethnocultural elements like local agricultural knowledge, tribal numeracy patterns, and indigenous environmental wisdom can be linked to STEM content meaningfully.

Gender-sensitive Teacher Development

The findings indicated that male teachers exhibited slightly higher awareness and engagement with ethnocultural practices (Hypothesis 2). This points to a need for focused support programmes that ensure all teachers, regardless of gender, are equally empowered to implement inclusive pedagogy. Training modules must consider gender-related experiences and encourage reflective practices.

Equitable Pedagogical Strategies Across School Types

Although no significant difference was found between government and private school teachers (Hypothesis 3), it is important to ensure that all schools, regardless of funding, are equally resourced and guided to implement culturally responsive practices. Policies should encourage schools to connect the curriculum with local community knowledge systems, particularly in multilingual and socio-economically diverse settings.

Curriculum and Textbook Reform

The moderate awareness among teachers reflects the need for stronger curricular alignment with ethnocultural perspectives. State and national boards should include content from local history, tribal knowledge systems, regional art, and folk narratives to make the curriculum more inclusive and contextually relevant (Rawat & Nagaraju, 2024).

Inclusion of Ethnocultural Elements in Pre-service Teacher Education

As the study revealed variation in understanding and engagement levels among teachers, integrating ethnocultural pedagogy into B.Ed. and D.El.Ed. syllabi are essential. This will ensure that new teachers are equipped from the beginning with the frameworks and tools needed to build inclusive, culturally responsive classrooms.

Development of Localized Teaching-learning Materials

Since many teachers rely on standard materials that may not reflect cultural diversity, education departments should support the creation of region-specific, multilingual, and culturally responsive instructional materials, co-developed by teachers, local experts, and community elders.

Conclusion

Overall, this study ratifies the important place of the ethnocultural convergence in the fostering of the inclusive, equitable, and context-appropriate education within the Indian academic forum. The varied

understandings from the educators indicate the need for deliberate, organized, and inclusive pedagogical interventions that match the cultures of the learners. Enmeshing ethnocultural sensibilities into the texture of educative action not only increases teaching effectiveness but also becomes a medium for keeping the indigenous knowledge system and intercultural discourse alive. After all, the realization of cultural plurality within the educational discourse is not just a pedagogical necessity, but a moral one in a globalized world of immense plurality.

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No funding was received for this study.

Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical Approval

This study was conducted in accordance with institutional ethical standards. Ethical approval was obtained from the Institutional Ethics Committee of Indira Gandhi National Tribal University.

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Digital Gamified Learning in Teacher Education: Insights from Pre-service Teachers in Kasaragod District

K. Thiyagu*, Mary Vineetha Thomas

Abstract

This study employs a descriptive survey methodology to assess the awareness, experiences, and perceptions of the B.Ed. trainees regarding digital gamified learning (DGL) within the Kasaragod district of Kerala state. The research aims to elucidate pre-service teachers' familiarity with DGL, first-hand experiences, interest levels, and preferred devices for such learning modalities. Results reveal a spectrum of familiarity levels among participants and a high interest in DGL, albeit with inconsistent practical engagement. The findings indicate that smartphones and laptops are most favoured for accessing DGL. Collectively, the respondents exhibited a positive outlook towards DGL, highlighting its prospective utility in future educational contexts. However, the study emphasises the necessity for enhanced training and exposure to fully harness the benefits of DGL in educational frameworks.

Keywords: Digital Gamified Learning, Pre-service Teacher Perceptions, Kasaragod District, Awareness, Experiences, Perception, Teacher Education.

Introduction

Traditional teaching and learning methods typically involve direct knowledge transmission in a classroom setting. As information technology has evolved, web-based learning has become a viable alternative. Educational games are particularly effective in this digital landscape, part of the broader multimedia learning environment. These interactive tools can significantly enhance engagement and effectiveness among younger students. Acknowledging this potential, researchers and game developers have suggested various models to improve the digital learning environment. However, many of these models fail to address the specific learning behaviours crucial for supporting the educational process in game-based learning environments (Tan et al., 2007). Digital gamified learning hinges on two core ideas: first, modern

learners have fundamentally evolved with digital technology; second, computer games can motivate today's students effectively (Prensky, 2005). Gamification has emerged as a valuable strategy in education, effectively motivating learners, fostering interaction, and promoting positive social outcomes. E-learning systems often leverage gamified elements such as points, badges, feedback, level progression, rewards, challenges, and other techniques to create more engaging and effective learning environments (Saleem et al., 2022). While numerous studies have explored gamification in education (Smiderle et al., 2020), its effectiveness remains a subject of debate. Despite integrating gamification into classrooms to enhance learning outcomes at various levels, there is still a lack of consensus on its true potential. This discrepancy may arise from the term 'gamification' itself, often associated with games, entertainment, and fun, which are not

traditionally linked to learning. Conversely, it is inaccurate to view gamification as a universal solution for both learners and educators (Papp, 2017).

Gamified learning is a teaching method that uses games to deliver educational content engagingly and enjoyably, drawing on motivational psychology. This approach involves designing interactive activities that help students progressively grasp concepts and achieve specific learning goals (Boche, 2019). This approach lets students use different game elements to improve skills and meet learning objectives. Prensky's 2001 view that educational software should use game design techniques is now widely recognised in educational technology research. Digital gamified learning (DGL) is a promising educational method that utilises video games to improve learning outcomes. It is particularly effective for today's digitally-savvy youth, enhancing visual literacy and interaction (Chaudhary, 2008). While some educators remain sceptical, DGL's potential for improving student engagement and knowledge retention is gaining recognition (Pivec, M., 2007). Various game platforms, such as Minecraft: Education Edition, Code.org and Tux Racer, demonstrate how video games can be integrated into classroom settings to create enjoyable learning experiences (Triantafyllou, A, 2022). A typology of four Digital Gamified Learning genres is proposed to help teachers understand the pedagogical process and challenges in implementing Digital Gamified Learning (Wu, 2018). Digital Gamified Learning can positively impact student engagement and achievement when designed with key game and instructional elements (Serrano, 2019). A game-based learning environment can incorporate elements such as scaffolding, problem-driven activities, exploration, context, agency, interaction, learning through doing, learning through failure, moments for reflection, character involvement, and overall engagement (An & Bonk, 2009).

Review of Related Literature

Compiling past research on the impact of gamified learning indicates that subjects such as social science, mathematics, and computer science are enhanced through game-based learning. Additionally, digital gamified learning contributes to cognitive, emotional, and social enhancements in the learning process.

Gamified learning can enhance 21st-century skills by integrating practical design elements and educational theories (Meihua Qian & Karen R. Clark, 2016). Combining cognitive, motivational, affective, and sociocultural frameworks in game design and research maximises their academic potential (Plass, J. et al., 2015). Student-centred digital gamified learning primarily focuses on single-player experiences and active learning but needs further study on multiplayer engagements and social aspects like mutual respect (Thomas E. Coleman & Arthur G. Money, 2019). Gamified learning in programming courses enhances the student experience, knowledge gain, and usability, with varying benefits based on location, educational background and the games played (Dan Zhao et al., 2022). Game design features in gamified learning promote engagement and learning at both cognitive and emotional levels, with external factors also influencing these outcomes (Azita Iliya Abdul Jabbar & P. Felicia, 2015). Gamified learning can enhance education by engaging learners and addressing mental, emotional and social aspects, but it must complement traditional approaches and address interdisciplinary competencies (Simon Greipl et al., 2020). Classcraft, a gamification platform, has the potential to optimize learning experiences (Thiyagu, 2021). By incorporating gamified rewards, interactive environments, and collaborative activities, Classcraft can fulfil the criteria for optimal gamified learning. This platform effectively facilitates optimal gamification learning processes, which can positively impact both learning outcomes and motivation (Zhang et al., 2021).

Game-based science learning promotes scientific knowledge and concept learning to enhance its potential for effective science education (Ming-Chaun Li & Chin-Chung Tsai, 2013). Digital gamified learning shows promising potential in elementary science education, particularly in content understanding, but more research is needed to confirm its effectiveness in other areas (Mahmood H. Hussein et al., 2019). Gamified learning environments can engage students in science learning and enhance motivation, resulting in fun while learning (Min Liu et al., 2014). The learning environment was enhanced through gamification, incorporating elements like point-based competitions, leaderboards, and Python programmer badges. This gamification strategy led to a notable improvement in learners' academic performance. Additionally, it stimulated self-directed learning, with a significant difference observed before and after its implementation (Palaniappan & Noor, 2022).

Gamify pedagogy in mathematics education shows positive gains in knowledge, cognitive skills, affection and behavioural change, with traditional teaching being the most popular comparison approach (Mahmood H. Hussein et al., 2021). Game-based learning-building services in engineering education can increase student engagement and make learning more meaningful. Still, more comprehensive approaches using advanced information tools are needed for future development (Kari Alanne, 2016). Using severe games and digital mini-games, gamified learning significantly increases learners' logical-mathematical reasoning and linguistic capabilities (Pérez, M. et al., 2018). Using teacher-authored games in computer science education, gamified learning is as effective as traditional teaching in knowledge acquisition but significantly increases learner motivation and enjoyment (López-fernández, D et al., 2021). However, selecting the appropriate combination of game elements continues to be a challenge for gamification designers and practitioners. This is due to the absence of established

design methodologies and the lack of a universal approach that can be applied to all gamification contexts (Khaldi et al., 2023).

Digital gamified learning, when effectively used in delivering the instruction, helps improve student engagement and interest in game design elements, enhancing learning outcomes (Qing Li et al., 2014). Digital gamified learning has become a mainstream educational tool due to ongoing research, the rise of the 'net generation' and the desire for interactive, engaging learning experiences (Richard N. Van Eck, 2006). Digital gamified learning offers undiscovered potential for universities and lifelong learning, transforming games from unserious activities into a new form of interactive content worth exploring (Pivec, M, 2007). Game design models can enhance the impact of educational computer games by providing immediate feedback, clear goals, and challenges matched to skill levels (Kiili, K, 2005). The value embedded in gamified learning plays a crucial role in shaping perceptions. However, the significant impacts of factors such as reasons for and against sustainable purchasing and sustainable purchasing attitudes, including the moderating effect of perceived sustainable expertise, vary between different groups (Zafar et al., 2024).

Objectives

Based on the study, the following objectives were formulated to:

1. Assess the level of awareness about digital gamified learning (DGL) among the respondents.
2. Investigate the extent of prior experience with DGL among the respondents.
3. Determine the frequency and depth of hands-on experience with DGL among the respondents.
4. Evaluate the interest level among respondents in learning subjects through DGL.
5. Identify the devices preferred by respondents for engaging with DGL.

6. Gauge the overall perception towards DGL among the respondents.
7. Measure the respondents' specific perceptions towards DGL concerning each evaluative statement.
8. Find out whether there exists any significant difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their gender, locality and subject stream.

Hypotheses

The following hypotheses were formulated based on the study:

1. There is no significant difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their gender.
2. There is no significant difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their locality.
3. There is no significant difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their subject stream.

Method

The researcher aims to explore the attitudes toward digital gamified learning among pre-service teachers in the Kasaragod district. A normative survey method was employed to gather data on these attitudes. Normative surveys, often called descriptive research, describe and interpret existing conditions or attitudes. This method utilises statistical norms and standards deemed typical for the specific group under study to ensure relevant and accurate data collection (John, W. Best et al., 2017). This sample represents a manageable and representative subset of the larger population, facilitating detailed research and analysis (Will, Curtis et al., 2013). In this context, the term 'normative' indicates an effort to ascertain what is considered normal or standard among a

specific group. In this case, the researcher collected data to understand student teachers' attitudes toward gamified learning in the Kasaragod district.

Population and Sample

The objective of the survey research is to outline the characteristics of a broader population. This goal is typically achieved by collecting data from a representative sample derived from that population. The initial phase of the sampling process involves defining the population in question. For this study, the population consists of all pre-service teachers currently enrolled in educational programmes within the Kasaragod district. Specifically, these include individuals engaged in courses like Diploma in Elementary Education (D.El. Ed) after 10+2 and B.Ed. after graduation. A total of 306 pre-service teachers from the Kasaragod district were chosen to constitute the sample. These participants collectively represent a variety of independent variables, including gender, subject specialisation, locality, age, and type of residence.

Tools

In this study, the researcher developed a 5-point attitude rating scale to gauge respondents' levels of agreement or disagreement with a series of statements. Each item on the scale offered five response options, ranging from 'strongly agree' to 'strongly disagree,' with values assigned from 1 to 5 (Thiyagu, 2021). Given that the research utilised a survey method, the researcher crafted a tool comprising a questionnaire to gather basic information and opinions about digital gamified learning features. This tool aimed to elicit specific responses from pre-service teachers, helping to assess their attitudes towards digital gamified learning in the Kasaragod district. The format of the questions and statements was carefully designed to capture pre-service teachers' attitudes accurately. The development of the tool involved an extensive review of related

literature and previous studies on similar topics. The researcher collaborated with her advisor to finalise the instrument, ensuring it included clear and appropriate instructions to guide participants towards providing accurate responses.

Findings and Interpretation

The following are the findings and interpretations of the result.

Objective 1: Assess the level of awareness about digital gamified learning (DGL) among the respondents.

Table 1: Analysis of the sample based on awareness of DGL

Awareness on DGL	No. of Pre-service Teachers	Percentage (%)
Yes	114	37.3
No	192	62.7

The sample analysis reveals significant insights into digital gamified learning (DGL) awareness levels among pre-service teachers in Kasaragod district. The findings are as follows: The data indicates that 37.3% of pre-service teachers know DGL. This subset of students has some level of familiarity with the concept and its application in educational contexts. Conversely, 62.7% of pre-service teachers are unaware of DGL. This indicates a significant gap in knowledge and familiarity with this modern pedagogical approach among most pre-service teachers. The findings suggest that most pre-service teachers in Kasaragod district need more awareness of DGL, with nearly two-thirds of the sample indicating unfamiliarity with this educational tool. This highlights the need for increased exposure and training in DGL for pre-service teachers to enhance their understanding and potential integration of digital gamified learning strategies in their future teaching practices. Efforts to bridge this knowledge gap involve incorporating DGL concepts into teacher education curricula and providing practical training sessions to

demonstrate the benefits and applications of DGL in the classroom.

Objective 2: Investigate the extent of prior experience with DGL among the respondents.

Table 2: Analysis of sample based on their previous experience in DGL

Experience on DGL	No. of Pre-service Teachers	Percentage (%)
Yes	61	19.9
No	245	80.1

The sample analysis based on pre-service teachers' attitudes towards digital gamified learning (DGL) revealed the following: Among the 306 students surveyed, 19.9% reported having experience with DGL. Conversely, 80.1% of the students indicated that they did not have any prior experience with DGL. The data suggests that most pre-service teachers (80.1%) lack prior experience with digital gamified learning. This finding indicates that almost all pre-service teachers in the sample are relatively new to DGL. Consequently, there may be a need for targeted training and professional development initiatives to familiarise these future educators with the concepts and practical applications of DGL, thereby enhancing their competence and confidence in integrating such innovative approaches into their teaching practices.

Objective 3: Determine the respondents' frequency and depth of hands-on experience with DGL.

Table 3: Analysis of sample based on previous experiences with DGL

Attempts in DGL	No. of Pre-service Teachers	Percentage (%)
1 time	51	47.7
2-5 times	37	34.6
5-10 times	10	9.3
More than 10 times	9	8.4

For the purpose of this objective, the frequency and depth of respondents' hands-on

experience with DGL were examined. Among the total of 306 respondents, only 107 indicated that they had practical experience with DGL. Consequently, the analysis was restricted to these 107 respondents, as they were deemed to possess the requisite expertise for meaningful evaluation.

The sample analysis based on the number of attempts in digital gamified learning (DGL) made by pre-service teachers revealed the following facts. The data indicates that nearly half (47.7%) of the pre-service teachers have engaged with DGL only once. Additionally, a significant portion (34.6%) have made 2 to 5 attempts. A smaller percentage of students (9.3%) engaged in DGL between 5 and 10 times, while an even smaller fraction (8.4%) participated more than ten times. These findings suggest that most of the students have had limited exposure to DGL, with the majority not progressing beyond a few attempts. This trend underscores the need for more opportunities and encouragement for pre-service teachers to engage consistently with DGL, which could enhance their familiarity and proficiency with this learning approach.

Objective 4: Evaluate the interest level among respondents in learning subjects through DGL.

Table 4: Analysis of sample based on interest to learn subjects through DGL

Interest on DGL	No. of Pre-service Teachers	Percentage (%)
Yes	230	75.2
No	76	24.8

The sample analysis based on pre-service teachers' attitudes towards digital gamified learning (DGL) revealed the following: The data shows that a substantial majority (75.2%) of pre-service teachers are enthusiastic about engaging in digital gamified learning courses. This high interest suggests a positive

attitude towards integrating innovative and interactive learning methods such as DGL into their educational practices. However, a notable minority (24.8%) of pre-service teachers are not interested in DGL courses. This may point to a need to address potential barriers, such as lack of familiarity with DGL, perceived relevance, or technological apprehensions. Tailored strategies to enhance awareness and demonstrate the benefits of DGL could help increase overall acceptance and participation among pre-service teachers.

Objective 5: Identify the devices preferred by respondents for engaging with DGL.

Table 5: Analysis of the sample in terms of the preferred device used for DGL

Preferred Device	No. of Pre-service Teachers	Percentage (%)
Tab	30	9.8
Laptop	159	52
Mobile phone	199	65

The sample analysis based on pre-service teachers' preference of devices for digital gamified learning revealed the following: The data indicates that most pre-service teachers (65%) prefer using mobile phones to participate in digital gamified learning. This preference suggests a high level of comfort and accessibility associated with mobile phones, making them a popular choice for engaging with DGL. Laptops are also a preferred device for a significant portion of the sample (52%), indicating their suitability for DGL activities. However, only a tiny percentage (9.8%) of students favoured tablets, which might reflect lesser usage or familiarity with this device type for educational purposes. These findings highlight the importance of optimising DGL content for mobile phones and laptops to cater to the majority preferences of pre-service teachers.

Objective 6: Gauge the overall perception towards DGL among the respondents.

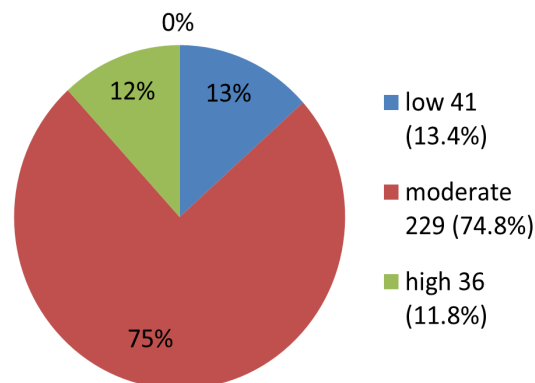
Table 6: Analysis of the sample in terms of their level of attitude towards DGL

Attitude towards DGL	Pre-service Teachers	Percentage (%)
Low	41	13.4
Moderate	229	74.8
High	36	11.8

The sample analysis based on the level of attitude towards DGL revealed the following: The data indicates that most pre-service teachers (74.8%) have a moderate attitude towards digital gamified learning. This suggests a general acceptance and openness to DGL among most students, though not necessarily a strong enthusiasm. A smaller segment of the sample (13.4%) exhibits a low attitude towards DGL, indicating some resistance or lack of interest in this learning approach. Meanwhile, 11.8% of the students have a high attitude towards DGL, demonstrating strong interest and positive

perception. These findings highlight the need for strategies to enhance the attitude demonstration of the benefits of DGL to foster a more favourable outlook across the board.

The following graph shows the level of attitude of pre-service teachers towards digital gamified learning (DGL)



Level of attitude of pre-service teachers towards DGL

Objective 7: Measure the respondents' perceptions of DGL concerning each evaluative statement.

Table 7: Analysis of the sample in terms of their perception of DGL

No.	Statements	SD F (%)	DA F (%)	N F (%)	A F (%)	SA F (%)
1	I feel more convenient if the subject is taught through digital games.	11 (3.6%)	32 (105%)	127 (41.5%)	110 (35.9%)	26 (8.5%)
2	Digital gamified learning is not suitable for all subject streams.	13 (4.3%)	79 (25.8%)	109 (35.6%)	90 (29.4%)	15 (4.9%)
3	Games-based learning utilizes gaming technologies to establish an engaging, motivating, and interactive virtual learning environment	23 (7.5%)	15 (4.9%)	70 (23.9%)	152 (49.7%)	46 (15%)
4	Evaluation is not easier and more accurate when using DGL	32 (10.5%)	121 (39.5%)	102 (33.3%)	29 (9.5%)	22 (7.2%)
5	Login with username and password provide digital safety and privacy in DGL	14 (4.6%)	31 (10.1%)	91 (297%)	125 (408%)	45 (14.7%)

6	The provision of rechecking and correction of answers make me comfortable while using DGL platforms	16 (5.2%)	17 (5.6%)	127 (43.5%)	122 (39.9%)	24 (7.8%)
7	DGL helps me to get and view my results quickly	15 (4.9%)	26 (8.5%)	77 (25.2%)	144 (47.1%)	44 (14.4%)
8	Learning through digital game platforms are clearer and easier to understand the content.	17 (5.6%)	15 (4.9%)	97 (31.7%)	141 (46.1%)	36 (11.8%)
9	Digital gamified learning can engage and motivate students, offering personalized experiences that enhance long-term memory and practical skills.	17 (5.6%)	16 (5.2%)	113 (36.9%)	125 (40.8%)	35 (11.4%)
10	System feedback through DGL platform helps me to reflect and knowing my achievement in learning progress.	10 (3.3%)	25 (8.2%)	118 (38.6%)	125 (40.8%)	28 (9.2%)
11	I believe that DGL is more systematic in execution and conduction.	13 (4.2%)	30 (9.8%)	129 (42.2%)	106 (34.6%)	28 (9.2%)
12	I feel using DGL allows learners to focus and concentrate more on the subjects.	12 (3.9%)	35 (11.4%)	30 (9.7%)	107 (35%)	22 (7.2%)
13	Always interested in learning through DGL because I can be able to retrieve the previous learning resources from the digital game platform.	15 (4.9%)	29 (9.5%)	132 (43.1%)	102 (33.3%)	28 (9.2%)
14	Through DGL I can improve my technical competency while using the technological devices and tools.	13 (4.2%)	27 (8.8%)	90 (29.4%)	116 (37.9%)	60 (19.6%)
15	I feel DGL is highly individualized in terms of time and pace.	17 (5.6%)	24 (7.8%)	121 (39.5%)	118 (38.6%)	26 (8.5%)

Results from the survey provide an overall picture of how pre-service teachers view digital gamified learning on various dimensions, such as convenience, engagement, technical adequacy, feedback, and individualisation. In general, the results show a largely positive response towards DGL, yet a large number of respondents were neutral across a number of statements, showing areas where extended exposure and familiarity are required.

Convenience and Appropriateness of DGL: Pre-service teachers indicated moderate

agreement on the convenience of DGL. Although 44.4% agreed or strongly agreed that DGL is convenient, a significant 41.5% were neutral. This indicates that although most appreciate the utility of digital gamification in learning, many are still unsure, perhaps because of lack of exposure. Likewise, for the suitability of DGL across subject streams, the feedback was mixed. A total of 30% agreed with the idea, but 30.1% disagreed and 35.6% did not have a view. Such a split suggests that although there are those who

think that DGL can be applied across fields, there are others who are doubtful about its applicability in all fields.

Engagement and Interactivity: One of the most emphatic areas of consensus was regarding engagement and interactivity. An impressive 64.7% of the respondents agreed or strongly agreed that game-based learning makes learning engaging and interactive. This suggests broad acceptance of DGL's ability to enhance learning and make it more engaging and fun. The idea that DGL increases engagement, motivation, and offers personalized experiences was also moderately accepted, with 44.4% in agreement, even though 41.5% were neutral. The positive agreement indicates that most teachers recognize the potential of DGL to increase deeper learning, though a lack of strong agreement suggests that the idea might still be intangible for some.

Assessment and Feedback: Pre-service teachers tended to have a positive perception of DGL regarding assessment and feedback. Fifty per cent of the respondents disagreed with the statement that it is not easy to evaluate using DGL, which suggests they believe it is effective for assessment. Furthermore, 50% agreed that system feedback using DGL facilitates reflection on learning progress. These findings align with the idea that DGL improves the process of evaluation by providing instant and explicit feedback. The high agreement rate here highlights DGL's function in encouraging formative evaluation and self-awareness.

Technical Features and Security: There was a clear appreciation of the technical features of DGL by the respondents. A high 55.5% accepted that employing a login system offers sufficiency, implying that they think that DGL platforms are secure and usable. In addition, 57.5% felt that DGL contributes to increasing their technical knowledge, pointing to a vital ancillary advantage of gamified learning – building digital literacy. The capacity for access to stored learning materials was also appealing to 42.5% of pre-service teachers, although 43.1% were

undecided, which might indicate either ignorance of this capability or lack of utilization in available platforms.

Transparency and Comprehensibility: Regarding transparency and understanding, 57.9% agreed that DGL makes content easier to understand, pointing to its effectiveness in clarifying complex concepts through visual and interactive formats. This positive perception supports the integration of gamification to aid content comprehension, especially for visual or experiential learners. Personalization and flexibility were supported moderately. Approximately 47.1% concurred that DGL is extremely personalized regarding time and tempo, and 42.2% believed that it enhances focus and concentration. Neutral answers, however, continued to be high (approximately 40%) for both, which indicates that the potential of DGL is indeed acknowledged but not necessarily the extent to which this can be delivered in personalized form in their respective learning contexts. On being questioned regarding DGL's systematic implementation, 43.8% concurred that it is more structured, but 42.2% were neutral. This again reflects uncertainty or lack of first-hand experience. Users who have utilized DGL to a greater extent might identify its structured nature, whereas others might require guided exposure to value its systematic nature.

In conclusion, the information indicates a generally positive attitude towards DGL among pre-service teachers, especially in terms of engagement, interactivity, feedback, technical proficiency, and understanding of content. The high level of agreement in these categories indicates that most respondents view DGL as a valuable and contemporary learning tool. Yet, the repeatedly high number of neutral responses to numerous statements reflects a high degree of uncertainty or lack of experience with DGL. Neutrality points to an openness to the idea, but pre-service teachers need more experience, training, and evidence-based interventions in order to be more confident in DGL's effectiveness in all areas. The results also point out that

DGL is received positively in areas such as motivation, assessment, and accessibility, but its applicability to all subjects and deeper customization aspects are areas that require further investigation and proof. Bridging these gaps with teacher training programmes, workshops, and exposure to effective DGL implementations may help turn neutral and negative attitudes into a more universally positive one. Finally, the data introduces DGL as a viable teaching method

with high perceived advantages, balanced by zones of doubt that can be overcome through professional development and pragmatic incorporation into pedagogical practice.

Hypotheses Testing

H₀1 There is no significant difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their gender.

Table 8: Difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their gender.

Gender	N	Mean	SD	Df	't' Value	'p' Value	Remarks at 5% level
Male	126	124.34	14.09	304	8.01	0.00	Significant
Female	180	110.66	15.13				

The above table shows that the computed 't' value is 8.01. Since $p < 0.05$, that is lesser than the significance level $\alpha = 0.05$, then the null hypothesis is rejected, and it can be said that there is significant difference in the mean scores of pre-service teachers' attitude towards digital gamified learning with respect to their gender. Thus, pre-service teachers' attitude towards the digital

gamified learning is affected due to their gender. Male pre-service teachers are better than the female pre-service teachers in their attitude towards DGL.

H₀ 2 There is no significant difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their locality.

Table 9: Difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their locality.

Locality	N	Mean	SD	Df	't' Value	'p' Value	Remarks at 5% level
Rural	130	112.2	12.12	304	7.52	0.00	Significant
Urban	176	122.3	11.14				

The above table shows that the computed 't' value is 7.52. Since $p < 0.05$, that is lesser than the significance level $\alpha = 0.05$, then the null hypothesis is rejected, and it can be said that there is significant difference in the mean scores of pre-service teachers' attitude towards digital gamified learning with respect to their locality. Thus, pre-service teachers' attitude towards the digital gamified learning

is affected due to their locality. Urban pre-service teachers are better than the rural pre-service teachers in their attitude towards DGL.

H₀ 3: There is no significant difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their subject stream.

Table 10: Difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their subject stream.

Subject Stream	N	Mean	SD	Source of Variation	Sum of squares	Df	Mean square	'F' Value	'p' value
Arts	98	119.8	15.7	Between Groups	66.45	2	33.22	0.131	0.877
Science	166	120.8	16.0	Within Groups	76827.20	303	253.55		
Language	42	120.8	13.3	Total	76893.65	Not significant at 0.05 level			

It is clear from Table 10 that the mean scores of pre-service teachers' attitude towards the digital gamified learning in the case of arts stream is 119.8 and corresponding standard deviation is 15.7. Moreover, the mean scores of attitude towards the digital gamified learning of science pre-service teachers and language pre-service teachers are 120.8 and 120.8, respectively, and their corresponding standard deviations are 16.0 and 13.3, respectively. However, the calculated value of F is not significant at any level ($F = 0.131$; $p > 0.05$). Therefore, the null hypothesis is not rejected. Hence there is no significant difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to the subject stream. Thus, pre-service teachers' attitude towards the digital gamified learning is not affected due to the subject stream.

The study found significant differences in the attitudes of pre-service teachers towards digital gamified learning (DGL) based on gender and locality. Male pre-service teachers showed more positive attitudes than females, and urban pre-service teachers scored higher than rural ones. These differences were statistically significant, leading to the rejection of the null hypotheses in both cases. However, no significant difference was observed based on the subject stream (arts, science, or language), as the F-value was not significant ($p > 0.05$). Therefore, while gender and locality influence attitudes of pre-service teachers towards DGL, subject stream does not appear to have an impact on these attitudes.

Discussion of the Study

The study examined the awareness, experience, and perceptions of digital gamified learning (DGL) among 306 pre-service teachers, offering essential insights into its current state in teacher education and identifying areas for improvement and future research.

Awareness and Experience with DGL: A significant gap in awareness and experience with DGL was found among the pre-service teachers. Only 37.3% were aware of DGL, and just 19.9% had any prior knowledge. This suggests that DGL has yet to be widely recognised or used in teacher education programmes. The lack of exposure may limit future educators' ability to adopt innovative teaching methods in their classrooms.

Limited Engagement with DGL: Most pre-service teachers needed more hands-on experience with DGL. Nearly half (47.7%) had only used DGL once, and 34.6% had used it two to five times. This limited engagement implies that pre-service teachers need more opportunities to explore and utilise DGL in their learning. More hands-on practice opportunities are required to build confidence and competence in this approach.

Interest in DGL: Despite the limited awareness and experience, there is strong interest in DGL among pre-service teachers. Most of them (75.2%) showed enthusiasm for participating in DGL courses. This positive attitude suggests a readiness to adopt innovative and interactive learning methods. However, the 24.8% who are not interested indicate that barriers such as

lack of familiarity, perceived relevance, or technological apprehensions must be addressed.

Device Preferences for DGL: Mobile phones (65%) and laptops (52%) were the preferred devices for engaging with DGL, emphasising the need to optimise DGL content for these platforms. Tablets were less favoured (9.8%), possibly due to lower usage or familiarity for educational purposes. Making DGL content accessible and user-friendly on mobile phones and laptops will cater to the majority's preferences.

Overall Attitude Towards DGL: Most pre-service teachers (74.8%) had a moderate attitude towards DGL, indicating general acceptance and openness. However, only 11.8% had a highly positive attitude, showing limited strong enthusiasm for DGL. Enhancing attitudes towards DGL could involve increased exposure, training, and showcasing its benefits.

Perceptions of DGL's Benefits: Pre-service teachers recognized several benefits of DGL, including its potential to engage and motivate students, facilitate efficient evaluation, and enhance technical competency. The positive perceptions of DGL's impact on learning engagement, focus, and content understanding indicate that many students value integrating gaming technologies into educational practices.

Educational Implication of the Study

The following are the educational implications of the study.

Enhanced Training and Exposure: Integrating DGL concepts into teacher education curricula and offering practical training to close the knowledge gap is critical. This approach will improve pre-service teachers' understanding and ability to apply DGL strategies in future educational practices.

Device Optimization: Since there is a preference for using mobile phones and laptops, it is important to ensure that DGL content is specifically tailored for these

devices. This adjustment will enable most pre-service teachers to engage more comfortably and effectively with DGL activities.

Promotion of Benefits and Overcoming Barriers: Overcoming obstacles like unfamiliarity, perceived irrelevance, or technological hesitations is essential. By showcasing the advantages and practical uses of DGL, educators can foster greater acceptance and involvement among pre-service teachers.

Enhancement of Evaluation Processes: Leveraging DGL to streamline and enhance evaluation methods can capitalise on the system's capacity to offer immediate feedback. This improvement can aid in maintaining and boosting the efficiency of result-sharing within educational environments.

Conclusion

This study evaluated pre-service teachers' attitudes towards digital gamified learning uncovering a generally favourable outlook. Many participants recognised its potential to improve learning experiences, engagement, and evaluation methods. However, the notable uncertainty among the teachers highlights a need for more training, exposure, and proof of DGL's effectiveness. Addressing these gaps can enable educational institutions to better equip future teachers with the skills to effectively incorporate innovative digital learning strategies, thereby enhancing educational outcomes.

The research aimed to assess the receptiveness of pre-service teachers towards DGL, which has the potential to revolutionise education for educators and learners alike. Navigating the changes that come with DGL is essential for students and teachers. In the competitive educational landscape, institutions continuously seek innovative and effective teaching and learning techniques that present opportunities and challenges. Teacher education programmes must develop strategic plans to leverage DGL benefits and tackle its challenges fully. The success of DGL integration depends

on the student's willingness to adopt new educational methods and robust support from their institutions. This involves fostering an environment conducive to game-based learning, simplifying administrative tasks, securing financial

backing, improving infrastructure, and enhancing the capabilities of the academic staff. Providing educators with technical and pedagogical support is crucial for seamlessly incorporating DGL into the educational framework.

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Strengthening Self-regulated Learning in Teacher Education: An Analysis of Policy Alignment and Curriculum Integration

Fathima Shajeena CP*, K. Abdul Gafoor

Abstract

Equipping educators with strong Self-regulated Learning (SRL) skills empowers them to handle the demands of a rapidly changing society and educational reforms. SRL enables future educators to become lifelong learners and agents for nurturing SRL in their students, ultimately contributing to positive social transformation. In this context, this study critically analyses key policy documents including the National Education Policy 2020, the National Council for Teacher Education (NCTE) Amendment Regulations 2021, the NCTE Curriculum Framework for Integrated Teacher Education Programme (ITEP), and the Suggestive Syllabi for Secondary Stage ITEP. The research objective is to critically examine these documents' explicit and latent references to enhance Self-regulated Learning (SRL) competencies among prospective secondary school teachers within the Integrated Teacher Education Programme (ITEP). The study utilizes a framework adapted from Zimmerman and Moylan's (2009) Cyclical Model of SRL, by reviewing post-2005 experimental interventions on student-teacher self-regulated learning skills; encompassing five key components (Metacognition, Self-efficacy, Self-monitoring, Motivation, and Self-directed Learning) and seven core strategies (Task-analysis, Reflective practices, Self-assessment, Collaborative learning, Feedback, Planning, and Problem-solving). NEP 2020 emphasizes integrating SRL strategies into teacher education programmes, fostering lifelong learners and reflective practitioners. The conceptual model adopted in the study confirms that the learners' awareness of their thinking process, use of individualised learning strategies, and sustained motivation facilitate the development of teaching professionals who can handle the uncertainties of the rapidly changing society and related emerging reforms in higher education. The analysis reveals that while NCTE's suggested syllabi explicitly incorporate SRL strategies within the course content, practicum, and assessment approaches during the four-year programme, only motivation receives substantial focus. This discordance calls for enhancing metacognitive awareness and cultivating positive self-efficacy beliefs among prospective teachers, empowering them to become lifelong learners and agents for imparting SRL in their professional practice. These observations of this study emphasize the importance of situated learning environments and a transformative teacher education approach to cultivate SRL abilities in teachers. Equipping educators with all important SRL skills that empower them to handle the demands of a rapidly changing society and educational reforms, aligns with national aspirations for social transformation.

Keywords: ITEP, NEP 2020, Metacognition, Self-directed Learning, Self-regulated Learning Strategies

Introduction

Teacher education in India has evolved from an unstructured training approach

as in the Monitoring and Alarming System (1800–1880) followed by the Instruction for Teachers (1882–1935), and Education for Teachers System (1940 - present), to a

British-inspired training programme in the pre-independent period (Singh, 2022). The need for well-trained teaching professionals to fulfil the needs of the diversely populated Republic of India has led to the development of a systematic and secular training programme (Gill, 1954) in post-independent India. Traversing from the University Grants Commission (1948-1949) to the National Education Policy (2020), teacher education and its practices have evolved into a professional programme integrating theoretical and pedagogical practices and training for fulfilling the changing trends at the global level.

The rapid social transformation at the global level increases the need for a regularly updated educational system and educational professionals. UNESCO in its Global Report on Teachers (2023), a collaboration between UNESCO and the International Task Force on Teachers for Education 2030, stated, “to ensure quality education to all and meet the education targets of the 2030 Agenda, teachers who are aptly trained, supported and valued are essential.” (Education 2030, 2024). Currently, teachers cannot insist that their responsibilities be restricted to helping students improve their cognitive abilities alone. In addition, teachers today should possess extensive subject knowledge and the skills required to organize work groups, support learning, and be effective educators. They must also provide instruction, attend to students’ psychological well-being, and support their social integration (Eacute & Esteve, 2000).

This demand for the upskilling of the professional commitments of the teaching community along with the transforming society is identified by the National Education Policy 2020. It emphasizes the need for the development of lifelong learners, reflective practitioners, and self-directed learners. For example, the proposed new age system of teacher education, namely the Integrated Teacher Education Programme

(ITEP), highlights the significance of these Self-regulated Learning (SRL) Components and Strategies. SRL practices enable future educators to become lifelong learners and agents for nurturing SRL in their students, ultimately contributing to positive social transformation. The NEP 2020 calls attention to the inadequate hiring, placement, working conditions, empowerment, and preparation of teachers, all of which discourage them from trying to meet the learners’ expectations. It focuses on how educators affect the concerned learners and the future of the country, and how crucial it is to motivate and enable them to achieve age-specific and stage-specific results.

Timeline of Integrated Teacher Education Programme in India

Assisting the developing minds of their learners in finding the underlying roots that allow seemingly disparate and distant objects to come together and blossom from a single stem is the task of educators. Curriculum integration is one way that educators can help accomplish this goal (Fogarty, 1991). The framework of an integrated course for pre-service teacher education offers a curriculum integrating the pedagogy, content, and practicum throughout four years. The Integrated Teacher Education Programme is a dual-major undergraduate degree programme focusing on both the discipline subject and pedagogy and practicum of education. It is one of the mandates of the National Education Policy 2020 which has to be implemented as the minimum degree for teacher professionals by the year 2030. The NEP 2020 policy document states, The 4-year integrated B.Ed. will be a dual-major holistic bachelor’s degree in education as well as a specialized subject such as language, history, music, mathematics, computer science, chemistry, economics, art, physical education, etc. Beyond the teaching of cutting-edge pedagogy, the

teacher education will include grounding in sociology, history, science, psychology, early childhood care and education, foundational literacy and numeracy, knowledge of India

and its values/ethos/art/traditions, and more. (NEP 2020, Para 15.5)

A timeline of the planning and implementation of the initial phases of the ITEP is elaborated in Figure 1.

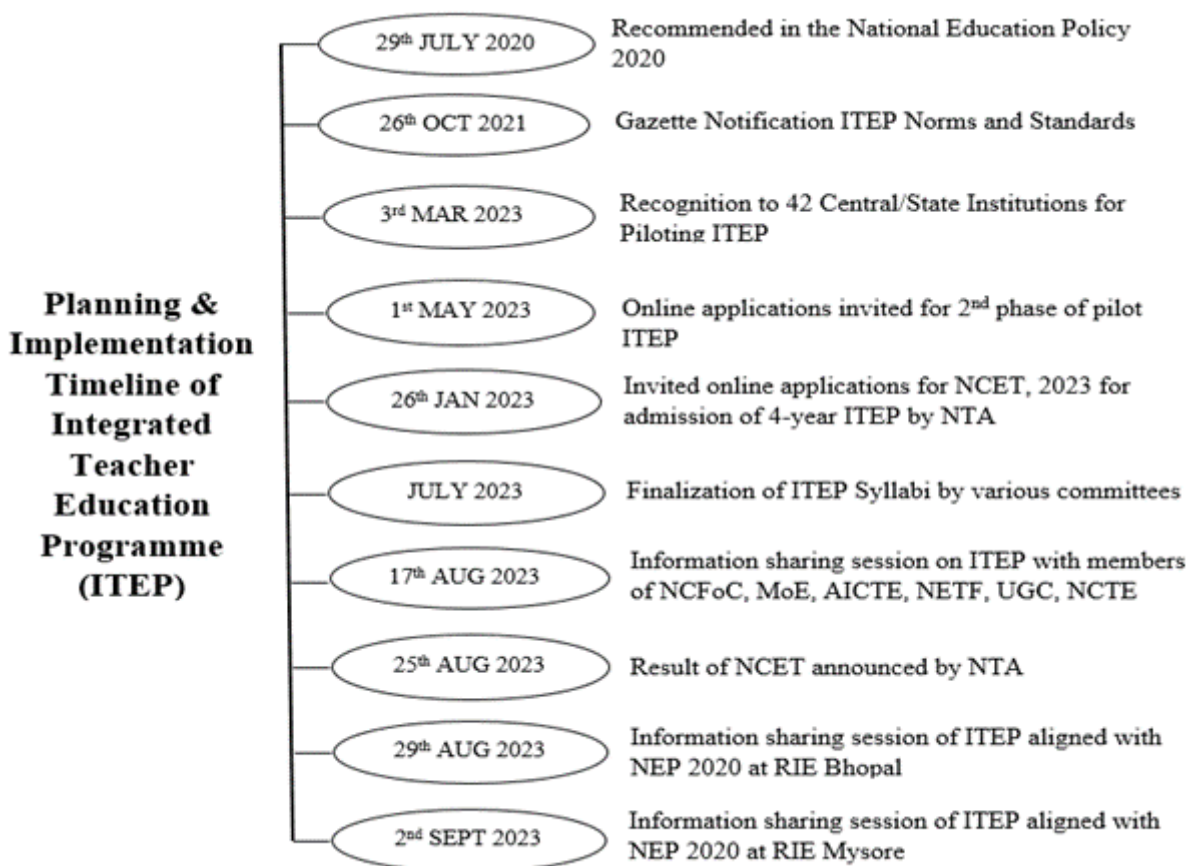


Figure 1: Timeline of Planning and Implementation of Integrated Teacher Education Programme (ITEP) [information extracted from NCTE website as of 10-08-2024].

Key Characteristics and Potential Future Paths of ITEP as Outlined by NEP 2020

The Integrated Teacher Education Programme (ITEP), introduced under the National Education Policy 2020 (Ministry of Education, 2020), is a four-year undergraduate programme designed for students who have completed Grade 12. Admission to this programme is facilitated through the National Common Entrance Test (NCET), conducted by the National

Testing Agency (NTA). The ITEP aligns with the NEP 2020's recommended 5 + 3 + 3 + 4 pedagogical and curriculum framework, which emphasizes comprehensive teacher preparation. Upon successful completion, graduates are awarded a bachelor's degree that integrates a dual major in education and a chosen discipline, providing eligibility for both teaching positions and postgraduate studies in education. The programme adopts a credit-based structure consistent with the Four-Year Undergraduate Programme

(FYUP) model outlined in NEP 2020. To accommodate diverse learning interests, the ITEP also offers flexibility in course selection, allowing students to choose intra-disciplinary or interdisciplinary minors. By 2030, the programme is expected to be implemented in institutions and universities equipped with the necessary faculty and infrastructure to support humanities and science disciplines, ensuring an enriched interdisciplinary learning environment.

Rationale and Objective of the Study

The 2030 Agenda for Sustainable Development' adopted by the United Nations in 2015 aims to transform the world into a better place for the present and future generations by elaborating on seventeen specific goals to be achieved globally by the year 2030. The Fourth Goal on the list, 'Ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all,' highlights the importance of the role of teachers and their professional development in guiding learners to identify their learning style and preferences and support them in modifying into effective learning habits to facilitate lifelong learning. Since its official declaration in 2016, the Sustainable Development Goals (SDGs) of the United Nations have been the base of major policy declarations among all developing and underdeveloped nations. The National Education Policy 2020 is an initiative to achieve Goal 4: Quality Education of the SDG 2030 in India. This leads to the rationale of the present study which aims to critically analyse the documents related to the planning and implementation of the Integrated Teacher Education Programme (ITEP), one of the breakthrough recommendations of the National Education Policy 2020, and trace the latent and explicit occurrence of Self-regulated Learning Components and Strategies in the respective documents to appraise its role in meeting the need for the development of teaching

professionals as lifelong learners who are aware of their cognitive processes and are successful reflective practitioners. To accomplish this, the following objectives have been framed.

1. To analyse the policy documents, viz. National Council for Teacher Education (NCTE) Amendment Regulations 2021, NCTE Curriculum Framework for Integrated Teacher Education Programme (ITEP), and Suggestive Syllabi for Secondary Stage ITEP to identify explicit and latent references of Self-regulated Learning (SRL) components and SRL strategies among prospective secondary school teachers within the Integrated Teacher Education Programme (ITEP).
2. To synthesize the findings from the analysis of policy documents to provide insights into the alignment between policy directives and the promotion of Self-regulated Learning (SRL) competencies within the context of teacher education for secondary school educators.

Methodology

The study employs a qualitative design in conducting the content analysis of the policy documents, viz. the National Council for Teacher Education (NCTE) Amendment Regulations 2021, the NCTE Curriculum Framework for Integrated Teacher Education Programme (ITEP), and the Suggestive Syllabi for Secondary Stage ITEP downloaded from the NCTE website. It adapts Zimmerman and Moylan's (2009) Cyclical Phases Model of Self-regulated Learning as the conceptual framework for identifying the latent and explicit occurrence of the Self-regulated Learning Components and Strategies in three key documents related to the planning and implementation of ITEP in teacher education institutions and universities in India.

Document analysis, as elaborated by Corbin and Strauss (2008) is a systematic procedure for reviewing or evaluating printed and electronic (computer-based and internet-transmitted) documents, and the 'content analysis of these documents is employed

in a less rigid, and more flexible manner to draw inferences from the content by acknowledging the mere presence or absence of certain words or phrases.’ (Cardno, 2018). This concept is described by George (2009, p.145) as ‘non-quantitative, non-statistical content analysis, which uses the presence or absence of a certain content characteristic or syndrome as a content indicator in an inferential hypothesis.’

This particular methodology enables to critically identify the latent and explicit content characteristic of the documents as an extension in fulfilment of the recommendations of NEP 2020 and the demands of Sustainable Development Goals 2030 Goal 4– Quality Education in the development of lifelong learners who gain competence for collaborative and self-directed learning through reflective practices in their professional teacher education programme. The content analysis process was initiated by searching for twelve keywords in the concerned documents. Of which five keywords were SRL Components (Metacognition, Self-efficacy, Self-monitoring, Motivation, and Self-directed Learning) and seven keywords were SRL Strategies (Task Analysis, Reflective Practices, Self-assessment, Collaborative Learning, Feedback, Planning, and Problem-solving).

The selection of these specific SRL Components and Strategies was based on the literature review of the experimental studies related to the effectiveness of Self-regulated Learning practices in teacher education since the year 2005. The documents were closely scanned to trace out the Self-regulated Learning Components and Strategies in their guidelines, core and elective course content, assessment practices, suggestions on the mode of transaction, course-specific practicum, and school internship practices. The findings were tabulated by specifying the section of the document that included content and guidelines regarding the SRL Components and Strategies and the aligned practices suggested for the effective development of SRL competencies.

Self-regulated Learning Components and Strategies in Teacher Education

‘Self-regulated Learning (SRL) is a proactive and constructive process where the learners set their learning goals, and monitor them through regular control of their cognition, motivation, and behaviour, guided by their set goals and the contextual features in the environment.’ (Pintrich, 2000, p. 453). In SRL, students engage in an intentional, deliberate, and self-directed approach to activities as part of the active, recurring, critical, and reflective process. This method helps each student develop a sense of self-determined learning (Zimmerman, 2008).

While establishing their cyclical phase, the model of Zimmerman and Moylan (2009) broke down the entire process of learners’ synthesizing the learning process for achieving a task into a few micro-level practices combined into three macro-level phases. It is a sequential paradigm where the learner is involved in the first phase of disposition by involving in task analysis, and strategic study planning through the application of motivational and self-efficacy beliefs. The task is further completed in the second phase, i.e., the performance phase by the application of their awareness of metacognition and self-directed learning components through the application of self-monitoring and collaborative learning techniques. The final phase in the cyclical model is the assessment process where the learner is involved in reflective and self-assessment practices and depends on constructive feedback for the modification of the strategies for subsequent performances (Panadero, 2017).

Taking teachers as key agents of social transformation and practical initiators of global learning trends in the classroom, they have a major role in creating opportunities for lifelong learning as recommended in the NEP 2020 document. Study results of the relationship between the self-regulation

of teachers and their respective students demonstrate the influence of self-regulated practices in teacher education which is beyond the sociodemographic characteristics of vulnerability in the learning environment, as the self-regulated learners achieve control of their learning, resulting from a sense of determination towards achieving their personal and academic goals (Sáez-Delgado et al., 2022). This emphasizes the significance of SRL in teacher education and the need for incorporating its intentional promotion into the public education policies that facilitate the teachers and their students. Kremer-Hayon and Tillema's (1999) study identifies the potential of Self-regulated Learning in teacher education, which can be implemented only through new organizational and curriculum structures and is also of the view that the prospective teachers have a greater positive attitude than the in-service teachers towards SRL in their personal and professional life. The higher level of appreciation for Self-regulated Learning practices among pre-service teachers needs to be extended to the practical level by providing instructions and opportunities to systematically implement it during their practicum (Tran et al., 2022).

The role of the teacher is shifted to the learners in a self-regulated learning-focused classroom as they engage in self-monitoring their ability to complete a task and analyse the driven data either individually or in groups (Metacognition); they set goals and select strategies based on self-monitored outcomes (Task-Analysis and Planning); they work towards the set goals by self-monitoring regularly to refine the strategies with the aid of the teacher (Reflective Practices), which can be essential to the continuing of a self-regulatory approach. As a result, the teacher is crucial in helping the students understand the need to develop academic self-regulation and motivating the dedication required to accomplish it (Zimmerman et al., 1996).

For the present study, Experimental Research in SRL in Teacher Education since the year 2005 was reviewed, which highlights

the role of Self-regulated Learning (SRL) in developing effective, autonomous, and reflective teaching professionals. A synthesis of thirteen experimental studies involving preservice teachers along with Zimmerman and Moylan's Cyclical Phase Model of SRL (2009) have been considered to select the SRL Components and Strategies for the document analysis of the present study. The findings of the experimental studies emphasizes the interplay of cognitive, metacognitive, motivational, behavioural, and contextual dimensions in the development of Self-regulated Learning competency among the prospective teachers. These components are repeatedly validated across varied intervention contexts such as mentorship (Perry et al., 2006), online learning environments (Anderton, 2006), reflective teaching modules (Tanriseven, 2014), and metacognitive training (Kramarski & Michalsky, 2009, 2010) demonstrating their significance in shaping teacher education curricula.

A unifying feature of these studies is the emphasis on cognitive and metacognitive processes, such as goal setting, planning, monitoring, and evaluation, which are essential for academic and professional growth (Kramarski & Michalsky, 2009; Michalsky & Schechter, 2013). Instructional approaches like hypermedia use, mind mapping, and electronic learning diaries (Dignath-Van et al., 2015) were found to enhance preservice teachers' abilities to engage in information processing, strategic organization, and elaboration. Additionally, motivational aspects including intrinsic goal orientation, academic self-efficacy, effort regulation, and causal attributions emerged as vital factors in sustaining learner engagement and professional perseverance (Guvenc, 2010; Ganda & Boruchovitch, 2018; Suhandoko & Hsu, 2020). These motivational elements strongly align with the aims of the National Education Policy (NEP) 2020 which is to prioritize learner autonomy and lifelong learning.

Another recurring theme in the literature is

the role of social and contextual strategies, such as collaboration, peer feedback, and mentor-supported learning. Studies have shown that opportunities for emulation, coaching, and shared reflection (Vrieling et al., 2012; Michalsky & Schechter, 2018) facilitate internalization of SRL behaviours, thereby reinforcing the significance of community-oriented and reflective teaching practices. Furthermore, behavioural and emotional strategies, such as time management, stress regulation, and task readiness, were consistently associated with enhanced teacher preparedness and emotional resilience in diverse classroom contexts (Tanriseven, 2014; Ganda & Boruchovitch, 2018). These findings are particularly relevant to the ITEP's emphasis on preparing emotionally intelligent and self-directed educators.

Through the detailed review of these experimental studies it can be understood that the consistent recurrence and effectiveness of SRL components across teacher education interventions affirm their theoretical and

practical relevance. Therefore, the inclusion of cognitive, metacognitive, motivational, behavioural, emotional, and contextual SRL dimensions enables a nuanced evaluation of how the ITEP curriculum cultivates the competencies needed for self-regulated, reflective, and contextually responsive teaching professionals.

The Cyclical Phase Model of SRL has undergone evolution since its first presentation in the year 2000 as it initially represented only the division of three phases of SRL. It was later revised in 2003 with various processes included in each phase of SRL (Zimmerman & Campillo, 2003), and was further specified in 2009 by adding more stages of activities in the performance phase and elaborating the interaction among all the three phases of SRL (Zimmerman & Moylan, 2009). The conceptual framework adapted for the present study by incorporating Zimmerman and Moylan's Cyclical Phase Model (2009) and the effective SRL Components and Strategies from the review of experimental studies since 2005 is represented in Figure 2.

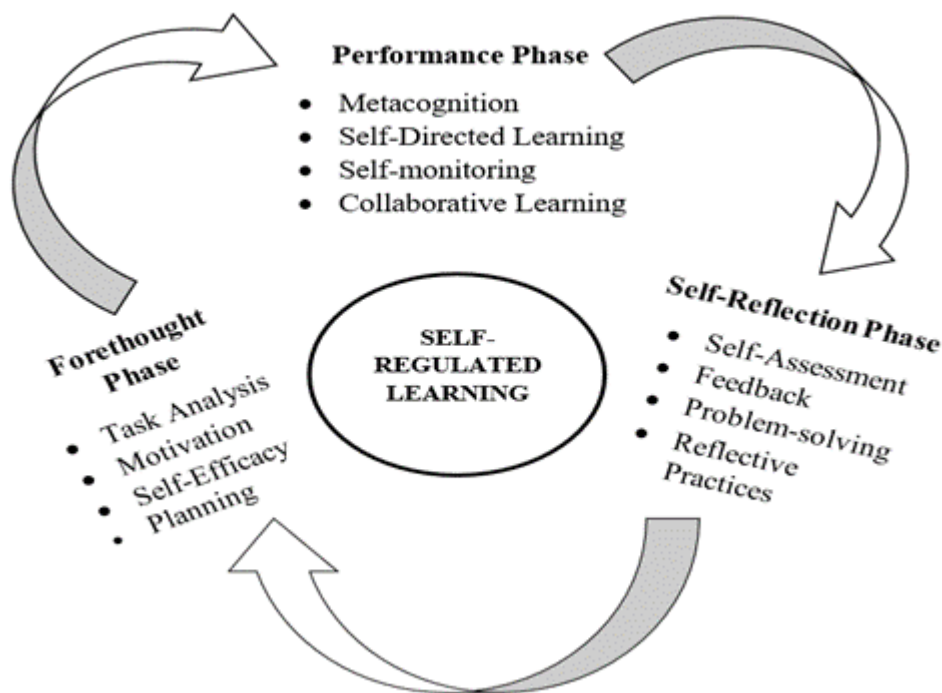


Figure 2: Conceptual framework adapted from Zimmerman and Moylan's (2009) Cyclical Phase Model of Self-Regulated Learning.

Results and Findings

Figure 3. has been developed to form a clear representation of the findings of the analysis on the path of achieving the major study objective of identifying the latent and explicit presence of opportunities for the development of SRL Competencies for student teachers in

the form of SRL Components and Strategies by analysing the policy documents, viz. the National Council for Teacher Education (NCTE) Amendment Regulations 2021, the NCTE Curriculum Framework for Integrated Teacher Education Programme (ITEP), and the Suggestive Syllabi for Secondary Stage ITEP.

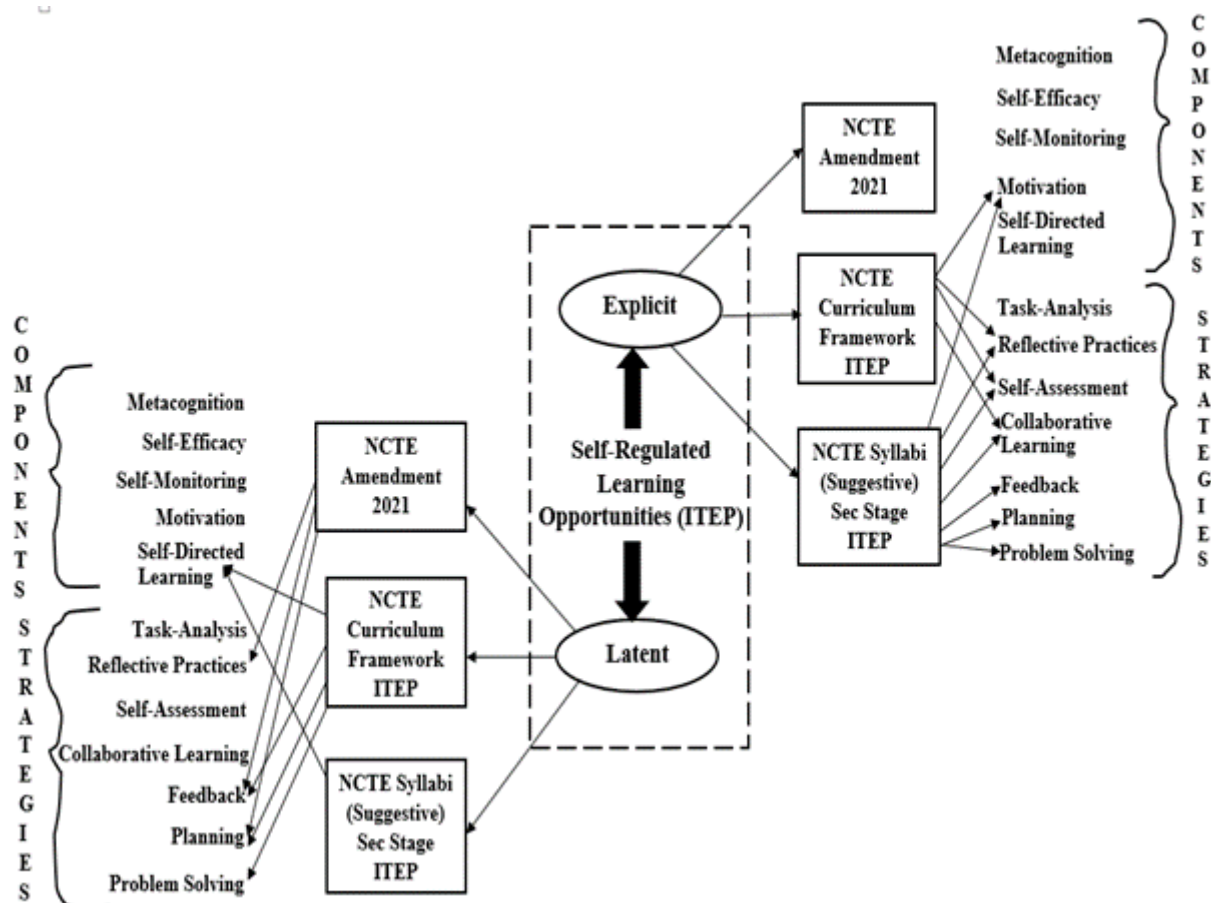


Figure 3. : Latent and Explicit occurrence of SRL Components and Strategies traced in the three policy documents in India.

The content analysis has identified motivation as the only SRL component explicitly embedded in the third semester course on 'Child Development and Educational Psychology'. This is evidenced through the inclusion of content addressing various theories and types of motivation and suggestive modes of transaction (NCTE Suggestive

Syllabi, Secondary Stage ITEP, 2022, p. 5). Additionally, motivation is emphasized in the instructions for conducting the 'Student Induction Programme', mandated for all student-teachers regardless of stage-specific specialization. This programme includes organizing motivational lectures delivered by eminent individuals from society (NCTE

Curriculum Framework, 2022, p. 24).

The Self-directed Learning component is latently evident in the document, reflected through indicators such as self-study, self-learning processes, and self-managed learning activities. These elements are integrated into the suggested modes of transaction across various courses and semesters of the ITEP programme (NCTE Suggestive Syllabi, Secondary Stage ITEP, 2022). The analysis of the documents further highlights the explicit integration of key SRL strategies, viz. reflective practices, self-assessment, collaborative learning, feedback, planning, and problem-solving within the

ITEP. These strategies are systematically embedded in sections such as 'About the Course', 'Learning Outcome', 'Suggestive Practicum', and 'Core Course Content'. Importantly, their inclusion is consistent across all core courses, irrespective of the subject specialization (NCTE Suggestive Syllabi, 2022, p. 58-151).

The detailed analysis of the concerned documents under study and the alignment between policy directives and the promotion of Self-regulated Learning (SRL) competencies within the context of teacher education for secondary school educators under the ITEP is given in Table 1.

Table 1: Alignment of teacher education policy directives with the strategies for the promotion of Self-regulated Learning (SRL) competencies post NEP 2020.

Sl. No.	Document	Self-Regulated Learning Components		Document Pages	Self-Regulated Learning Strategies	
		Presence in Document	Suggested Practices		Presence in Document	Suggested Practices
I.	National Council for Teacher Education (NCTE) Amendment Regulations 2021	The Gazetted Document does not mention any specific Self-regulated Learning Components that are to be included in the ITEP.		Page. 13	Reflective Practices Curriculum and Programme Implementation session. • Develop Reflective Thinking • Create opportunities for reflective thinking	Maintain Reflective Reports
					Feedback Curriculum and Programme Implementation session. • Create opportunities for Teaching and Feedback	Maintain Records of feedback
					Planning Curriculum and Programme Implementation session.	Maintain Records of Planning

II.	NCTE Curriculum Framework for Integrated Teacher Education Programme (ITEP)	<u>Motivation</u> • Student Induction Programme in Semester I	<u>Motivation</u> • across stage-specific specialization	Page 24	<u>Reflective Practices</u> Curriculum and Pedagogical Principles guiding ITEP [Included in Instructions for School-based Activities] • Space for Reflective Dialogue • Reflective Thinking • Reflective Practitioners	Reflective Group Discussions/ Workshops/ Seminars
		<u>Self-Directed Learning Core Course</u> • Understanding Self-directed work <u>Practicum</u> • As attributes that are to be demonstrated by student-teachers	---	Page 15	<u>Self-Assessment</u> Core Course component in Assessment and Evaluation (Semester 6) As Approaches to Assessment and Evaluation	---
		---	---	Pages 11, 12, 27, 28, 34, 40, 42, 43, 44, 48, and 49	<u>Collaborative learning</u> • Curricular and Pedagogical Practices Guiding ITEP • Stage-specific Content cum Pedagogical Courses • Promote Collaborative Learning	• School-based Research Projects • Network of Schools for Practice
					<u>Feedback</u> In Assessment and Feedback Course (Semester 6) As an approach to Assessment and Evaluation	---

					Planning • Mentioned 18 times in the whole document.	• Maintain records of the planning process.
III.	Suggestive Syllabi for Secondary Stage Integrated Teacher Education Programme (ITEP)	Motivation • Content Cum Pedagogy Courses • In the Course on Teacher and Society • As Core Course Content	---	Pages 5, 6, 51, & 186	Self-Regulated Learning Strategies* Pages (58-151) Core Course Content Instructions for Practicum Learning Outcomes. Suggestive Mode of Transaction	• Suggestive Practicum.
		Self-Directed learning • Mentioned in the Suggestive Mode of Transaction	---	Page 191	*Except Task-Analysis which is latently nor explicitly mentioned as an SRL strategy in any of the three documents.	

Table 1 shows the results of the in-depth document analysis conducted on the three foundational sources of the Integrated Teacher Education Programme (ITEP):

1. National Council for Teacher Education (NCTE) Amendment Regulations 2021
2. NCTE Curriculum Framework for Integrated Teacher Education Programme
3. Suggestive Syllabi for Secondary Stage Integrated Teacher Education Programme

The purpose of this analysis was to explore the explicit and latent presence of Self-regulated Learning (SRL) components and strategies in these texts and to identify alignment with SRL principles relevant to teacher education.

1. National Council for Teacher Education (NCTE) Amendment Regulations 2021

The Gazette Notification for the NCTE Amendment Regulations 2021, though crucial as a statutory and regulatory foundation for ITEP, contains no explicit mention

of Self-regulated Learning components. However, references to core SRL strategies can be found in the section on Curriculum and Programme Implementation (page 13). These include a focus on reflective practices, where institutions are encouraged to 'develop reflective thinking,' 'create opportunities for reflection,' and 'maintain reflective reports.' In addition, the regulation highlights the importance of planning and feedback, although not in the language of SRL research. The directive to maintain records of planning and to create space for teaching and feedback suggests an embedded value on pre-instructional goal setting, strategic decision-making, and self-monitoring, even if they are not articulated as such. These SRL-linked practices appear in embedded forms, pointing to the need for curricular implementers to interpret and extend these practices through pedagogical design and assessment processes.

2. NCTE Curriculum Framework for Integrated Teacher Education Programme

The curriculum framework offers significantly richer integration of SRL elements across several domains of curriculum and pedagogy. The concept of motivation, a central pillar of SRL, is embedded explicitly within the Student Induction Programme in Semester I, as well as across the stage-specific specialization courses (p. 24), emphasizing student engagement and ownership of learning from the very beginning of the programme. A strong presence of reflective practices is noted under the Curriculum and Pedagogical Principles. Reflective practices for the prospective teachers is integrated through school-based activities such as reflective dialogues, group discussions, workshops, and seminars. This recurring emphasis suggests the framework's recognition of self-evaluation and personal meaning-making as essential to teacher development.

Another core SRL domain, self-directed learning is introduced latently in both core course content and practicum sections. Student-teachers are expected to demonstrate attributes of autonomy and initiative in their learning, particularly during field engagement. Additionally, self-assessment practices are emphasized in the context of assessment and evaluation, particularly in Semester 6. This points to an evolving understanding of learners as active agents capable of tracking and regulating their own progress. Further, collaborative learning is promoted through school-based research projects and stage-specific content-cum-pedagogical courses. This aligns with socially shared regulation of learning, where learners co-construct understanding and regulate their tasks in group settings. The feedback mechanism is formalized in the assessment and feedback course of Semester 6, where it is positioned as a tool for formative assessment and reflective improvement. Planning is mentioned 18 times at various places throughout the document suggesting its foundational role in structuring

curriculum implementation and student learning. Therefore, this recurring focus demonstrates alignment with Zimmerman's and Pintrich's emphasis on the forethought and performance phases of learning.

3. Suggestive Syllabi for Secondary Stage Integrated Teacher Education Programme

The Suggestive Syllabi for Secondary Stage Integrated Teacher Education Programme document presents the most detailed operationalization of SRL strategies within course content. Motivation is the only SRL component that has been explicitly embedded in various content-cum-pedagogy courses, particularly in the course titled Teacher and Society, indicating that the emotional and value-based engagement of learners is foregrounded in teacher identity formation.

A major section of the syllabi (pages 58–151) explicitly discusses SRL strategies within the core course content, practicum instructions, learning outcomes, and modes of transaction. These strategies are integrated in a highly contextualized form, reinforcing the B.Ed. student-teacher's role as a self-regulating practitioner during planning, instruction, reflection, and field engagement. The document also supports Self-directed Learning through its emphasis in the suggestive mode of transaction (p. 191), wherein learners are encouraged to take initiative in navigating course materials, practicum activities, and professional inquiries. However, one notable omission across all three documents is the explicit treatment of task analysis, which remains only implicitly embedded in other SRL-related activities but is never addressed as a formal component of planning or strategy use.

Across the three ITEP related documents, the presence and scope of Self-regulated Learning components vary. While the NCTE Regulations 2021 establishes a minimal and implicit foundation, the curriculum framework and suggestive syllabi offer a progressively stronger and more

operationalized integration of SRL strategies. Reflective practices, motivation, self-assessment, planning, collaborative learning, and feedback are recurring themes—underscoring a gradual shift from regulatory policy toward a pedagogically enriched and learner-centred vision of teacher education.

Discussion and Conclusion

Educational policy documents have always been a topic of scrutiny from various angles based on the needs of the stakeholders. The recommendations outlined in the policy documents decide the upliftment of the quality of educational practices in the country. The policy documents have always followed the guidelines put forward in the global context especially by the United Nations Organization as an initiative to address the rights and needs of individuals as global citizens. The National Education Policy 2020 is a step towards achieving Goal 4: Quality Education of the Sustainable Development Goals 2030.

The recommendations for teacher education in NEP 2020 envisioned the need for an interdisciplinary approach to develop the teaching profession into a flexible field of expertise in the concerned field of subject knowledge parallels with the pedagogical and methodological practices. The multidisciplinary approach is addressed through the implementation of the Integrated Teacher Education Programme (ITEP) in the teacher education institutes and universities in India. The ITEP is not a completely new system of teacher education as the Regional Institutes of Education (RIEs) of NCERT which are located in different regions of the country have been successfully implementing integrated teacher education programmes at graduate and postgraduate levels since its year of functioning in 1963. Since its implementation, various educational commissions and committees have applauded and criticized the effectiveness of the four-year integrated teacher education programmes conducted by the RIEs (Parida, 2016).

Teacher training starts during the pre-service teacher education programme and continues throughout the teaching career of the professional in the form of in-service training and various professional development courses. The need for a well-structured Continuous Professional Development (CPD) for the teacher community is highly recommended in the NEP 2020. The significance of lifelong learning opportunities and competencies for teachers is thus justified by the demand for transforming themselves and their skill set based on the needs of the changing classroom demands. Lifelong learning is the aspect that demands hold on one's metacognitive awareness, and self-efficacy, with a sustained motivation from within and the learning environment.

Research in Self-regulated Learning has been gaining prominence through its effectiveness on the learners' academic achievement. It empowers the learners to regulate and modulate their learning practices based on the needs of the task or goal at hand. The path towards achieving SRL has been made possible through empirically proven models of SRL developed in the past few decades of research in this area. The present study has adapted the Cyclical Phase Model of SRL (Zimmerman & Moylan, 2009) which enhances the acquisition and control of learning strategies and improves the performance of low-achieving students and the academic achievements of high-performing students (Torre & Daley, 2023).

The content analysis of the policy documents of ITEP planning and implementation has revealed the presence of SRL components, viz. Motivation and Self-directed Learning in the instructions and guidelines for Curriculum Planning and Implementation of the ITEP. These instructions are not aligned with the practices suggested for their attainment, except for the suggestive syllabus of ITEP for secondary stages which includes course content on the Motivation component. It is also found that the SRL components, viz. metacognition, self-efficacy, and

self-monitoring have no representation in the three key documents of ITEP. An inquiry into the requirements of teachers' metacognitive skills by Lin et al. (2005), elaborates on the need for adaptive metacognition, involving self and environmental changes for successful teaching in diverse classroom situations. An observational study conducted in the area of student-teachers' self-efficacy for instructing self-regulated learning in the classroom by Gan et al. (2020) stressed the need for scaffolding and instruction of self-regulated learning in the teacher education programme practicums to foster self-regulated approaches in their teaching and learning process. According to Bloom (2013), the practice of setting realistic but challenging goals and monitoring progress should be fostered in primary and secondary classroom instruction as it results in a greater sense of self-efficacy and a higher level of motivation in the learning process. Educators with the competence to self-monitor and reflect upon their teaching process can prove to be successful in developing it among the future learners they come across. These specific findings of earlier studies in the area of Self-regulated Learning draw attention to the significance of incorporating the practice of the three essential SRL components- metacognition, self-efficacy, and self-monitoring alongside motivation and self-directed learning - into teacher education programmes. These components are found to be least prioritized in the futuristic ITEP curriculum, which aims to transform teacher preparation into a multidisciplinary field of study by 2030.

The SRL strategies chosen for the study, viz. reflective practices, self-assessment, collaborative learning, feedback, planning, and problem-solving have a significant presence in the policy documents under analysis. They appear in the document sections of instructions for the implementation of various curricular objectives as well as the opportunities provided for course-related practicum and school-based internship. The content analysis also reveals that the

Self-regulated Learning strategy task-analysis has not been latently nor explicitly dealt with in the current policy documents of the Integrated Teacher Education Programme. The prospective teachers when trained with the SRL components and strategies would be competent enough to apply them in their future classroom activities and train their students to develop into lifelong learners through the opportunities provided in the learning environment. The teachers, when well versed in the content and practice of Self-regulated Learning, turn into practitioners of SRL for their professional growth and also to create innovative and engaging learning scenarios. Thus, over time, students' motivation and deep-level processing processes are considerably increased when teachers adhere to the principles of self-regulated learning (Rozendaal et al. 2005).

Zimmerman et al. (1996) are of the view that teachers are most effective when they function as models, consultants, and coaches in the process of developing a self-regulatory level of study skills among diverse learners. Therefore, to implement a self-regulated learning model in classrooms, teachers must be able to demonstrate the use and effectiveness of SRL strategies, keep track of the student's progress, plan the integration of SRL practices within the curriculum, and foresee and prepare for the students' questions regarding various aspects of SRL. To cultivate this competency for developing into an expert in creating a self-regulated learning environment, the prospective teachers should be equipped with training at various levels during their teacher education programme practicum.

The teacher aspirants could implement their SRL competencies in real classroom situations with a representation of students from various social, economic, and educational levels. This exposure to learners from various age groups, social backgrounds, and learning environments could help prospective teachers understand their varying learning needs and tailor the instructional design according to them. The

knowledge and practice of SRL acquired in the teacher education classroom can be applied during the school internship process to work innovatively and according to the changing needs of their students and society. NEP 2020 emphasizes integrating SRL strategies into teacher education programmes, fostering lifelong learners and reflective practitioners. The conceptual model adopted in the study confirms that the learners' awareness of their thinking process, use of individualized learning strategies, and sustained motivation facilitate the development of teaching professionals who can handle the uncertainties of the rapidly changing society and related emerging reforms in higher education. Equipping educators with all important SRL skills will empower them to handle the demands of a rapidly changing society and educational reforms and align with national aspirations for social transformation.

Implications of the Study

The aim of the qualitative content analysis of the policy documents, viz. the National Council for Teacher Education (NCTE) Amendment Regulations 2021, the NCTE Curriculum Framework for Integrated Teacher Education Programme (ITEP), and the Suggestive Syllabi for Secondary Stage ITEP, was to critically evaluate the presence of SRL components and strategies required for the development of the 21st century teaching professionals. The Sustainable Development Goals 2030 identifies the requirement for transforming our education through 'ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all' and this can be possible through the implementation of a transformative teacher education programme as a primary step towards achieving this goal.

The findings from the analysis of policy documents gave further insights into the

alignment between policy directives and the promotion of Self-regulated Learning (SRL) competencies within the context of teacher education for secondary school educators, specifically,

1. The SRL components, viz. metacognition, self-efficacy, and self-monitoring have no representation in these documents which aim to uplift the teacher education as equal to any other professional education that demands the learners' involvement after their senior secondary education. Awareness of one's metacognition empowers the learner to regulate the learning process according to the task and available resources. Self-efficacy facilitates the learners with the confidence to take up the tasks and set goals based on their previous learning experience. The self-monitoring component of SRL aids the learners' task performance phase by regularly synthesizing the activities and making necessary changes for the betterment.
2. The SRL strategy task-analysis has not been latently or explicitly dealt with in the current policy documents. Task-analysis is the initial stage appearing in the forethought phase of the cyclical model of SRL. This provides learners with the opportunity to critically analyze the task at hand and brainstorm the possibilities for making the process and its completion an effective and innovative one.
3. The teacher education programme curriculum should incorporate opportunities for Situated Learning for the prospective teachers. The policy documents on ITEP envision the course content and practicum that develop teachers who can transform the learners' thought processes and learning habits according to the needs of the transforming world without altering their sustainable existence. This can be possible through the practice of situated learning in the form of internship opportunities for prospective teachers in multiple background schools.

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Twice-Exceptionality (2e): A Perspective of Pre-service and In-service Special Educators

Tanvi Pahwa*, Mohd Noor Alam**, Aerum Khan*** and Mohd Faijullah Khan****

Abstract

This research aims to study the awareness of pre-service and in-service special educators about twice-exceptionality and characteristics of twice-exceptional (2e) learners in the National Capital Region of Delhi (Delhi NCR). Twice-exceptional learners are characterized by the coexistence of high intellectual abilities and specific learning challenges or disabilities, or any other developmental disability making a unique set of needs that demand specialized attention in educational settings for the learner. This study employs a comprehensive survey method, engaging a diverse sample of 132 in-service and pre-service special educators teaching in inclusive schools across Delhi NCR. The pre-service teachers are the teacher trainees of B.Ed. and M.Ed. Special Education programmes doing their teaching practice under the supervision of the school teachers and supervisors from their institutes. This was done to explore the awareness levels among them about the twice-exceptional learners in their schools, the teaching practices for twice-exceptional learners that are followed, and to explore the existing gaps and requirements for professional development of special educators to work with individuals with twice-exceptionality. The findings of the study help to understand the existing learning gaps in the awareness levels of educators working in inclusive schools of Delhi NCR, the addressing of hindrances in the optimal support to twice-exceptional learners to begin with addressing their duality and dual uniqueness nature of learning and gifted skills. Furthermore, this study explores the influence of various factors which may affect the understanding of the specific needs of twice-exceptional learners in classrooms, such as teaching experience, educational background of the educators, educators' awareness levels about disabilities and giftedness, and deep understanding of multiple exceptionalities that might exist in an individual and the process of finding suitable solutions to the child and the parents to cushion the learning support for the individual. The implications of this study suggest that there is an opportunity gap, educational gap, training gap and lack of resources for diverse learning needs that has led to broaden the gap in understanding dual exceptionalities and, moreover, there is no evidence of any suggested practices or educational plan to be followed or to teach such learners in the near future. Finding of the study reveals that 70% of special educators are aware of the term 'twice-exceptionality,' however, only 53% of special educators are aware of the traits of twice-exceptional learners. The study also found that Individualized Education Plans (IEPs) are the most widely used strategy, with 80% of educators relying on it followed by differentiated instructions and assignments used by 58% of educators to cater to the learning needs of twice-exceptional learners. The findings of this research reflect that most of the educators believe that there is an urgent need to learn about the concept of twice-exceptionality to develop new strategies which are suitable for the dual nature of such learners to address their gifted skills as well as learning challenges.

Keywords: Twice-exceptionality, disability, dual-exceptional, giftedness, special education, specific learning disability.

Concept of Inclusion and Inclusive School

Inclusion refers to the act of making a person or thing part of a group or a collection. As per Oxford Learner's Dictionary, inclusion is the fact of providing equal opportunities and resources for people who might otherwise not get them, for example, people in the minority groups or who are disabled. In the context of this research, an 'inclusive school' refers to an educational institution that actively adopts the philosophy and practices of inclusive education. This means that the school is structured to accept and educate all students, regardless of their physical, intellectual, social, emotional, linguistic, or other conditions to develop their skills and realize their full potential (UNICEF, 1953). Specifically, an inclusive school includes the learners with differences in abilities, learning styles, and backgrounds as a resource, not a problem. It ensures that all learners are welcomed into age-appropriate, regular classrooms and are provided with the necessary support and resources along with required accommodation which may include differentiated instructions, individualized education plans and accommodated curriculum according to the learning limitations of the individual (UNESCO Convention against Discrimination in Education, 1960). The inclusive schools ensure the presence of special educators and counsellors within the school who perform specialized knowledge and resources that are designed to plan and implement learning environments and personalized instructional methods that meet the needs of diverse learners to address complex and diverse needs of all learners with disabilities and unique gifted skills and twice-exceptional needs (The Alliance for Inclusive Education). This study implicitly focuses on the practices within these inclusive schools to understand how well they are prepared to identify and cater to the unique needs of all the learners. Although there is a concept of thrice exceptionality as well, which describes individuals who are gifted, having learning

disability and belong to a minority (cultural/ social/ racial/ ethnic/ economic) groups, for example, a gifted student with dyslexia who is also from an economically weak family, the present research takes the two traits under consideration and deals with the concept of twice exceptionality only.

Historical Background of Twice-exceptionality

The term twice-exceptionality was introduced in western parts of the globe where the educators were able to recognize various gifts in learners with disabilities in their classrooms. Many authors have published their experiences with twice-exceptional learners that laid the foundation for understanding giftedness and disabilities from 1923 to 1970. Hollingworth's book *Special Talents and Defects: Their Significance for Education* introduced the term 'gifted,' for those who also exhibited learning difficulties in 1923. The term 'twice-exceptionality' was first introduced in the early 1970s and was later worked upon for almost two decades with practical experiences of educators and learners with dual exceptional characteristics to recognize learners as both gifted and with disability. In between the years 1975 and 1980, the Federal legislation in the United States introduced definitions for both 'learning disability' and 'giftedness' by establishing guidelines to address the educational requirements of learners with dual nature of exceptionalities. During that period, the evolution of twice-exceptionality where the learners were recognised to possess both advanced capabilities and concurrent challenges, however, the interventions were not appropriate to cater to learning needs and challenges of learners and support their disabilities. In the next decade, this domain witnessed a continuous development, notably by major organizations like the Special Populations Division of the National Association for Gifted Children (NAGC, 2020), the primary aim of establishment of these organizations was to advocate and to address

the specific needs of twice-exceptional (2e) learners (Baldwin, et al. 2015; Gierczyk & Hornby, 2021).

Later in between the years 1980 and 2000, the Javits Gifted and Talented Students Education Act (1988) was launched as a federal program in 1989, that acted as a stimulating research project aimed at helping educators in deepening the understanding of the unique and diverse learning needs of 2e learners (Guzlowski, 2013). In the same year, John Hopkins University organized its first conference on 'dual-exceptional' learners. A major milestone occurred in between the years 2004 and 2014 with the reauthorization of the Individuals with Disabilities Education Improvement Act (IDEA, 2004) that formally recognized the dual nature of such learners by acknowledging that the learners with disability may also possess exceptional talents in different domains. This policy made an important role in closing the existing gaps in identification of learning disability and in collaborating using the multidisciplinary approach to meet the diverse learning needs of 2e learners (Baldwin, et al., 2015). In 2014, the term 'twice-exceptionality' was first formally acknowledged by the US government as denoting learners who simultaneously demonstrate exceptional abilities along with disabilities require specialized educational strategies to cover their learning challenges and meet their unique learning requirements (Kurup & Dixit, 2016; Antony, et al., 2021; Chen, et al., 2022).

In contrast, the concept of twice-exceptionality is relatively novel with the Indian educationists and researchers in the field of education and disabilities, as they have just prioritized special education and meeting the learning needs of learners with disabilities and then also began to address giftedness and exceptional talents of few learners separately, however, overlooking the coexistence of both giftedness and disabilities in the same learner (Antony et al., 2022). This has led to the absence of formal identification or standardization of tools to identify such learners (Lim, 2021) and labelled as twice exceptional which led to masking of creative

abilities and exceptional talents which led to addressing them as disabled learners (Kurup & Dixit, 2016; Khan & Khan, 2023). Masking refers to how giftedness in an individual hides the disability or the disability hides the giftedness, making it extremely challenging to identify a learner's profile and actual diagnosis of the strengths and limitations.

For example, writing difficulties, attention issues, and slow processing lowers the academic output of a learner, leading teachers to assume the child is an average or struggling learner. In some other cases, gifted skills or traits like advanced reasoning and creativity skills get unnoticed because of the disability that dominates the child's learning and performance in the class.

Another example, strong verbal and reasoning skills and memory of a learner compensate for the learning difficulties, appearing to cope academically as they perform better than the peers in oral and conceptual tasks that leads the teacher to miss the underlying disability and leads to delayed support for such learners. In India still we need to work on school policies that clearly define twice-exceptionality as a distinct category, resulting in limited institutional support in identification and intervention. Schools rely heavily on psychometric assessments designed for single exceptionalities; there are no standardized tools for identifying learners with co-existing giftedness and disabilities. Families and schools often interpret difficulties as behavioural issues rather than manifestations of dual nature of the exceptionalities, delaying early diagnosis and support for such individuals. There is a significant lack of studies focusing on twice-exceptional learners with Indian cultural, curricular, and multilingual environments. The gap in awareness levels of special educators and the in-depth knowledge and understanding of giftedness with disability and the co-existence of the two in an individual is a new dimension which is yet to be explored in the field of inclusion and disability. Although there is usage of the term in the private sectors in medical practitioners administering the psychometric

assessments on individuals, where they are adopting international tools to assess the exceptional traits of individuals, however, the government sector is yet to accept and develop policy on the same.

Twice-exceptional children are those who demonstrate both advanced cognitive abilities or talents (giftedness) and one or more disabilities, such as specific learning disabilities, ADHD, or autism spectrum disorder. (IDEA, 2004). Gagné differentiates natural abilities from developed skills and talents. According to his theory, a disability can interrupt the developmental process through which abilities are converted into talents. According to Gagné, disability functions as a negative catalyst and it interferes with environmental and intrapersonal factors like motivation, perseverance and self-regulation which are essential for talent development.

Renzulli's three ring conception of giftedness views giftedness as an interaction of above-average ability, creativity, and task commitment. The presence of disability may weaken task commitment, for example, writing avoidance, slow processing, frustration in task completion, leading teachers to misinterpret the child as lazy or distracted. Creativity and higher order abilities remain masked/hidden or are only expressed in non-traditional formats like art, music, problem-solving, conceptual oral responses.

A learner might create imaginative artwork, showcasing exceptional talent in visual arts,

but face difficulties in focusing during long periods of traditional classroom instruction due to ADHD (Baum, 2001; Baum, 2014). These learners often display intense focus on areas of interest, such as a learner who shows remarkable aptitude in computer programming but has social interaction challenges due to Asperger's syndrome (high-functioning form of ASD) (Jung & Hay, 2018; Al-Hroub & Whitebread, 2019; Gierczyk & Hornby, 2021). Some learners exhibit advanced problem-solving skills, coupled with learning disabilities such as dyslexia or ADHD. Some learners display strong verbal abilities, but struggle with social interactions due to conditions like autism spectrum disorder (Reis et al., 2022). Advanced problem-solving skills, creativity, asynchronous development, social difficulties, perfectionism, emotional intensity, and inconsistency in academic performance are common traits observed among twice-exceptional learners (Al-Hroub, 2014; Sofologi & Bonti, 2023). Learners with twice-exceptionality also have behavioral challenges like anxiety, depression, phobia; communication and social skills may be impacted too. Learners with 2e characteristics show dual nature of exceptionalities, the gifted skills and impacted behavioural challenges that exist in learners who are gifted along with challenges in academic areas such as reading, writing, comprehension, spelling, displaying characteristics of learners with learning challenges (Jung & Hay, 2018).

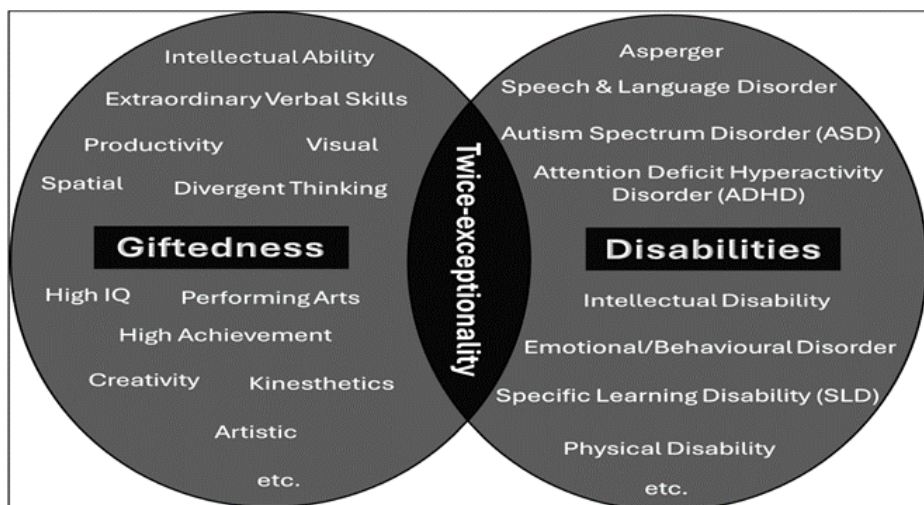


Figure 1: The co-existence of Giftedness and Disabilities (Twice-exceptionality)

Figure 1 showcases a Venn diagram to illustrate the concept of twice-exceptionality by showing how giftedness and disabilities coexist within the same learner. The left circle lists the traits of giftedness in an individual such as high intellectual, cognitive abilities, creative and artistic talents, advanced verbal or spatial skills, divergent thinking, strong memory; while the right circle lists the disabilities such as specific learning disability, autism spectrum disorder, attention deficit hyperactivity disorder, speech and language disorders, social-emotional difficulties, behavioural challenges, or physical impairments. The middle, overlapping section in the figure represents twice-exceptional traits in a learner who possesses exceptional strengths and significant challenges simultaneously. This helps us understand the concept of masking of such learners; their giftedness masks their disabilities, or their disability masks their gifted skills, leading to inconsistent performance and misidentification of the strengths and challenges of the learner. To recognize such learners, the special educators require deep understanding of the dual profiles recognizing their potentials and their needs to support the 2e learners and provide them with appropriate interventions. Khan & Khan (2022) conducted a study on identification and understanding the characteristics of gifted children from the lens of educators adopting strategies to work with children with both disabilities and gifted skills. Antony et al. (2021) conducted a study focusing on finding the awareness and understanding of teachers about twice-exceptionality and employed a phenomenological approach to gain insights into the lived experiences of teachers regarding their work and interactions with twice-exceptional learners. They interviewed teachers and published the perception of them and found that there is a major gap in knowledge and awareness on the conflicting with learners with disabilities and twice-exceptional learners. Al-Hroub's (2021) research on 30 students with twice-exceptionality and their educators examined

the instruments and resources that were used to accommodate the special and diverse needs of these learners. The research helped in addressing the challenges in administering both psychometric and dynamic assessment instruments. The primary challenge indicated the assessing of the learners' giftedness and in understanding the structured process of finding learners' learning disability with special gifts.

Role of Teachers in Identifying of Twice-exceptional Learners

Identifying twice-exceptional learners is a complex process that involves the coexistence of giftedness and a disability. These learners exhibit high cognitive abilities such as high motivation, exceptional intellectual abilities and creativity (Al-Hroub, 2014; Sofologi & Bonti, 2023). Jung & Hay (2018) researched and found that the identification and special attention lacks within the educational programmes and recommended Gagne's model (2012, 2017) to make the framework more comprehensive to help in recognition of underachieving gifted learners with difficulties. The lack of formal identification systems further exacerbates this issue, particularly in India. Teachers' direct involvement and experience in working with diverse learners and their recommendation is the primary step in finding a learner's unique abilities and talents along with his/her challenges and struggles in learning. The identification and support of these learners require a nuanced understanding and specialized training, which is often lacking among educators. The challenge lies in the fact that disabilities can mask abilities and vice versa (Baum, 2014; Silverman, 2007; Kurup & Dixit, 2016). Learners with both exceptionalities require a thorough assessment of both areas. These students often go unnoticed because they do not show typical behaviours like failing grades or behaviour problems. Accurate identification involves experts from both fields understanding the dual nature of these diagnoses, as behaviours can overlap

and complicate the diagnosis (Antony et al., 2022). General education teachers or special educators and counsellors fail to identify learners as gifted when the learners fail to come under the umbrella of 'giftedness' with above average intellectual quotient along with exhibiting major behavioural and social challenges. There should be some standardized assessments to administer dual exceptionalities catering to the giftedness and disability in a person which makes it possible to distinguish and label a person as twice-exceptional. Even experienced teachers find it challenging to work with learners with exceptional abilities and disabilities. They are resistant to adapt to modern teaching strategies like curriculum adaptation, modification and accommodation of learners to provide them with suitable support according to their individual learning patterns (Silverman 2007; Reis, et al., 2014). The engagement between the teacher and a learner fosters positive learning and impacts twice-exceptional learners to be motivated and nurture their unique talents (Wang & Neihart, 2015). Many educationalists suggest that the assessment should be multi-level and should cater to various components of learning of a child. This way the child gets opportunities to perform the skills that the child exhibits and on the basis of that evaluation, the child's gifts and challenges can be addressed to develop a useful educational plan. To support these learners effectively in inclusive classrooms, educators need to employ tailored strategies such as differentiated instruction, individualized education plans (IEPs), assistive technologies, and social skills training (Al-Hroub, 2014; Al-Hroub & Whitebread, 2019). Despite the implementation of various strategies to identify the unique traits of twice-exceptional learners, it is still a challenge to encounter a pattern that could be used as a general identification parameter for twice-exceptionality in a learner. These challenges often stem from a lack of awareness and understanding among special educators about the unique needs and instructional

approaches required for twice-exceptional learners, along with inadequate access to specialized training and resources, and inflexible educational systems (Antony et al., 2021).

Consequently, these students frequently do not receive the well-rounded support necessary for both academic and personal growth. Schools are now struggling to cater to the needs of such learners starting from identifying them due to lack of trained educators and then in providing appropriate assessment tools and instructional materials that are tailored to the needs of twice-exceptional learners. This lack of resources significantly hampers the ability of educators to address the needs of twice-exceptional learners. Enhancing investment in the targeted resources includes adaptive technology, specialized interventions, and dedicated support personnel to help in improvement of the learning outcomes for twice-exceptional students.

Need for the Study

Although international scholars and researchers have expanded the understanding about twice-exceptionality in the past two decades, the concept remains insufficiently explored within the Indian context. Most of the existing studies in India on special education focus on specific disabilities, inclusive practices, or gifted education as a separate domain, rarely acknowledging the coexistence of high ability and disability within the same learner. Research on twice-exceptionality has expanded significantly providing critical insights into the cognitive, social and emotional needs of such learners. Early foundational work by Baum, Owen, and Dixon (1991) highlights the masking effect, where the giftedness conceals disability and vice versa. Assouline et al. (2011) further advanced the developing diagnosis frameworks for gifted children with learning challenges, emphasizing on psychoeducational assessment. Later Reis, Baum, and Burke (2014) stressed more

upon the importance of strength-based interventions to better support the unique profiles of twice-exceptional students. Studies from Australia and the United Kingdom by Neihart & Betts (2010) and Foley-Nicpon (2011) expanded the discourse by documenting the social-emotional complexities of such learners recommending counselling and differentiated instructions. Works emerging from neurodiversity research including Ronksley-Pavia (2015) and King (2005) emphasized the teacher biases and mainstream classroom barriers in the learning and development of 2e learners, and how project-based learning and dynamic assessments would benefit in understanding the unique profiles of twice-exceptional learners as well as in improving engagements and academic outputs of such learners. Kurup & Dixit (2016) also reveals the gap in addressing this population of learners, documenting the need of understanding the uniqueness of gifted skills and the challenges that the learners manifest and work on both the extremes parallelly.

Although the notion of twice-exceptionality is widely acknowledged in Western nations, it has received limited attention within the Indian educational framework (Lim, 2021). The research aims to bridge that gap by exploring how pre-service and the in-service special educators in India perceive and understand the needs of twice-exceptional learners. This research aims to explore the prevalence, teaching practices currently in use, and opportunities available to educators to work with individuals with dual exceptionalities. By reading the present literature, a conclusion was drawn that there is lack of awareness about the term 'twice-exceptional,' educators fail to understand the coexisting traits in an individual and what educational needs the individual would require. Moreover, special education training programmes in India do not include any training modules on twice-exceptionality.

The National Education Policy (NEP, 2020) has recently introduced policies for gifted students, but it does not address

twice-exceptionality. Current Indian special education policies do not recognize or integrate the concept of twice-exceptionality, leaving a significant gap in understanding and supporting students who are both gifted and have disabilities. Undertaking this research will not only help in the addressing of existing gaps about identification and assessment procedure for the educational needs of twice-exceptional learners in India, but will also serve as a basis for recommending improvements in the education of teacher trainees and enabling the formulation of more targeted strategies to help such learners in the creation of appropriate resources to better support the learners with twice-exceptionality. It will help in pushing the policy-makers, educationalists, to realize the full potential of such learners and support the unique learning needs for them. Hence, such contribution to the society is essential to explore the viewpoint of special educators' knowledge and awareness about twice-exceptionality (2e).

Objectives of the Study

1. To examine the extent of understanding about the concept of twice-exceptionality among pre-service and in-service special educators in Delhi NCR.
2. To explore the instructional strategies employed by the special educators in Delhi NCR to support the identified/potential learners with twice-exceptionality.
3. To identify the primary resources used by the special educators of Delhi NCR in addressing the educational needs of learners with twice-exceptionality.

Research Methodology

This research employed descriptive survey research design to systematically investigate the current state of awareness and practices regarding twice-exceptionality (2e) among special educators. The methodology utilized a cross-sectional survey approach. The survey instrument was administered to gather data from pre-service and in-service

special educators working in schools across the Delhi NCR. It incorporated both quantitative (Likert Scale, multiple-choice) and qualitative (open-ended) questions to capture a comprehensive, mixed-methods view of the participants' awareness, current interventions, and teaching strategies related to identifying and supporting 2e learners. The use of a mixed-methods approach enhances the depth and breadth of the findings.

Sample

The target population for this study consisted of all pre-service and in-service special educators actively employed or training within inclusive schools across the Delhi NCR. A snowball sampling method was employed to collect survey data from special educators and teacher trainees working in inclusive schools of Delhi NCR. Initial contact was made through educational networks which included the colleagues and batchmates pursuing their bachelor's or master's degree, and later the juniors from the department who are presently the teacher trainees were given the survey to be filled and forwarded to their classmates and teachers of the schools in which they are completing their teaching practice. Lastly, the survey was circulated by the researchers, teachers, and seniors in the WhatsApp professional groups of special educators of Delhi NCR. The sample demographics included a total of 132 special educators, 70% of female and 30% of male respondents. The professional distribution included 68% in-service teachers and 32% pre-service special educators.

The survey included question statements such as "How familiar are you with the term 'twice-exceptional learners'?" "How confident do you feel in your ability to identify twice-exceptional learners in your classroom?" "How often do you collaborate with special education teachers or specialists to support the needs of twice-exceptional learners?" "What resources or tools do you currently use to support your understanding of twice-exceptional learners?" to ask the special

educators working in the inclusive schools about their knowledge and understanding about twice-exceptionality.

Tool Development and Data Collection

The researchers developed a structured questionnaire for the special educators to assess their level of awareness, understanding about twice-exceptionality (2e), strategies and resources used by them after a rigorous review of 27 national and international research articles. The tool was designed to align directly with the study's objectives. The questionnaire comprised a total of 15 items including 13 closed-ended questions and two open-ended qualitative questions. The 13 closed-ended questions were four-point Likert scales and multiple-choice to generate quantitative data on awareness levels, strategies used, and resources available currently for twice-exceptional learners. The questionnaire was validated by a panel of six subject-matter experts/senior academics in the field of special education. Before the main data collection, a pilot study was conducted with a small group of 15 special educators who were excluded from the main study to test the tool's practicality and internal consistency, confirming its reliability. The final questionnaire was deployed using a Google Forms platform to ensure efficient data capture and distribution. The link was circulated to the targeted sample via professional email lists and WhatsApp groups of special educators within the Delhi NCR special education community. Data collection took place over a four-week period, resulting in a final collection of 132 complete responses.

The survey questionnaire was conceptually grounded in well-established models of giftedness and twice-exceptionality primarily drawn from Renzulli's Three-Ring Conception of Giftedness, helping framing questions about whether teachers can recognise gifted traits even when disabilities suppress performance. Gagné's Differentiated Model

of Giftedness and Talent (DMGT) helped in framing questions about barriers in recognizing the gifted and disability traits in an individual.

Data Analysis

The collected data were subjected to a rigorous analysis process involving both quantitative and qualitative methods. Quantitative data were first compiled and cleaned using MS-Excel. Descriptive statistics, including Chi-square test, frequencies and percentages were calculated to summarize the participants' awareness levels and strategies used by the special educators and the results were visualized using bar graphs. The open-ended responses were analyzed using thematic analysis to identify common, recurring themes and insights related to educators' specific challenges, intervention strategies, and perceptions of twice-exceptionality.

Findings

Level of awareness about twice-exceptionality among special educators

Figure 2 represents the responses of special educators' level of awareness

and experience with twice-exceptional learners. The majority of respondents, i.e. 70% of special educators, are aware of the term 'twice-exceptionality.' However, this recognition does not uniformly translate into an understanding of the specific characteristics or traits of twice-exceptional learners, as only 53% of the educators reported being aware of the traits of twice-exceptional learners. This gap in knowledge is further highlighted by the fact that 42% of educators have encountered twice-exceptional learners in their classrooms, yet a larger proportion (58%) have not. Therefore, there is a need to make special educators aware of the characteristics or traits of twice-exceptional learners, so that they can identify the twice-exceptional learners in their classrooms. The responses also suggest a substantial need for professional development in this area. While 39% of special educators have received training, whereas the majority (61%) have not received training on teaching twice-exceptional learners that shows a critical need for more comprehensive training programmes.

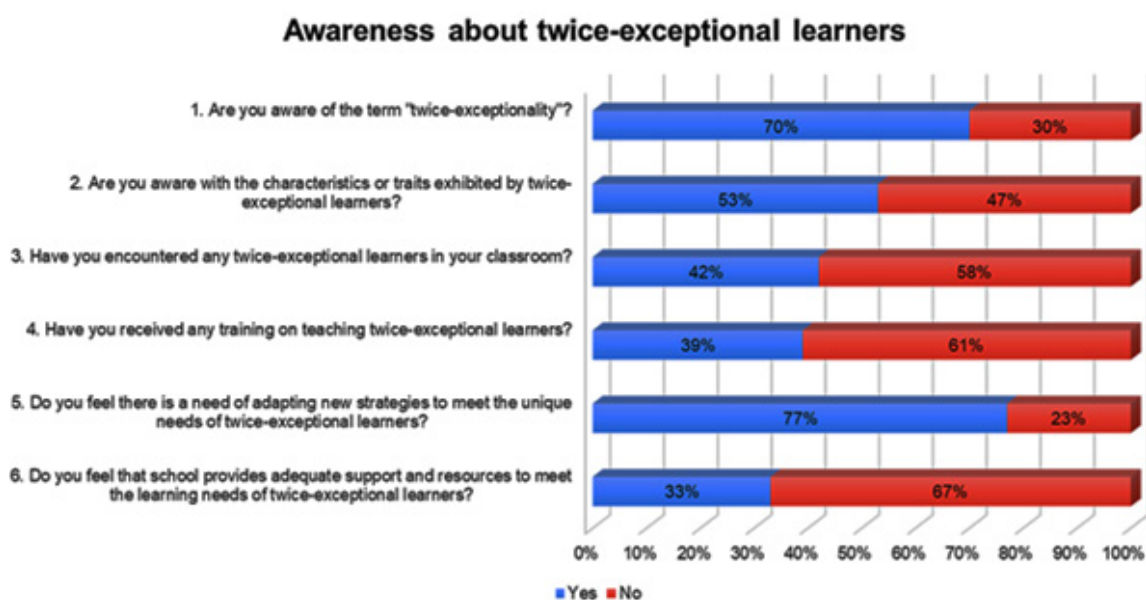


Figure 2: Awareness about Twice-exceptionality

This necessity is shared by the 77% of respondents who believe there is a need to adapt new strategies to meet the unique needs of twice-exceptional learners, emphasizing the urgency for evolving educational practices and methodologies. Only 33% of special educators share that schools provide adequate support and resources to meet the learning needs of twice-exceptional learners, while a significant 67% do not agree. In conclusion, the responses indicate a clear recognition of the concept of twice-exceptionality among

special educators is inappropriate and there is an urgent demand to help the educators to get a deeper knowledge about the same to help acknowledging the learners' needs first and then preparing appropriate strategies to cater to those unique needs. It also highlights significant gaps in understanding, training, and institutional support. Addressing these gaps is essential for improving educational outcomes for twice-exceptional learners and ensuring that special educators are well-equipped to meet their diverse and complex needs.

Table 1. Case processing summary of respondents

Case Processing Summary						
Cases						
Experience * Awareness	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
	132	100.0%	0	0.0%	132	100.0%

Table 2. Cross tabulation of experience and awareness

Experience * Awareness Cross tabulation					
Awareness					Total
			No	Yes	
Experience	3-5 years	Count	2	14	16
		Expected Count	4.8	11.2	16.0
	5-10 years	Count	16	30	46
		Expected Count	13.9	32.1	46.0
	Less than 1 year	Count	14	28	42
		Expected Count	12.7	29.3	42.0
	Less than 2 years	Count	0	4	4
		Expected Count	1.2	2.8	4.0
	Less than 3 years	Count	8	16	24
		Expected Count	7.3	16.7	24.0
Total		Count	40	92	132
		Expected Count	40.0	92.0	132.0

Table 3. Chi-Square values of experience and awareness

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.864a	4	.302

Likelihood Ratio	6.423	4	.170
N of Valid Cases	132	--	--
a. 3 cells (30.0%) have expected count less than 5. The minimum expected count is 1.21.			

Table 4. Symmetric measures of experience and awareness

Symmetric Measures			
		Value	Approximate Significance
Nominal by Nominal	Phi	.192	.302
	Cramer's V	.192	.302
N of Valid Cases		132	--

Tables 1-4 show the values of Chi-square test of two variables, i.e. awareness about twice-exceptionality and years of experience. The relationship between 'experience' and of awareness' was not statistically significant. The Pearson Chi-Square test yielded a value

of 4.864 with 4 degrees of freedom, resulting in a high p-value of .302. Since this p-value is well above the standard .05 significance level, we fail to reject the null hypothesis, meaning the differences in awareness across the five experience groups are likely due to chance.

Table 5. Case processing summary of respondents

Case Processing Summary						
Cases						
Professional Training * Awareness	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
	132	100.0%	0	0.0%	132	100.0%

Table 6. Cross tabulation of professional training and awareness

Professional Training * Awareness Cross tabulation					
Awareness					Total
			No	Yes	
Professional Training	No	Count	30	50	80
		Expected Count	24.2	55.8	80.0
	Yes	Count	10	42	52
		Expected Count	15.8	36.2	52.0
Total		Count	40	92	132
		Expected Count	40.0	92.0	132.0

Table 7. Chi-Square values of professional training and awareness

Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.980a	1	.026	--	--

Continuity Correction ^b	4.153	1	.042	--	--
Likelihood Ratio	5.177	1	.023	--	--
Fisher's Exact Test	--	--	--	.033	.019
N of Valid Cases	132	--	--	--	--

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.76.

b. Computed only for a 2x2 table

Table 8. Symmetric measures of professional training and awareness

Symmetric Measures			
--	--	Value	Approximate Significance
Nominal by Nominal	Phi	.194	.026
	Cramer's V	.194	.026
N of Valid Cases		132	--

Tables 5-8 show the Chi-square values of two variables, i.e. professional training and level of awareness. The relationship between 'professional training' and 'awareness' shows a statistically significant association between the two variables. Based on the data (N=132) valid cases, the Pearson Chi-Square test yielded a value of 4.980 with 1 degree of freedom, resulting in a p-value of .026. Since this p-value is less than the conventional significance level of .05, the null hypothesis of no association is rejected, confirming that training and awareness are related. Specifically, the data indicates a positive relationship; 80.8% of special educators who received professional training reported 'Yes' to awareness, compared to only 62.5% of those who did not receive training that advocates professional training appears to significantly increase the likelihood of awareness.

Teaching practices and key resources referred by the special educators to support twice-exceptional learners

Figure 3 represents the data of the current teaching practices the special educators

currently use to support the learning of twice-exceptional learners, Individualized Education Plans (IEPs) emerged as the most commonly usable strategy. The majority of respondents (80%) utilize this method to meet the unique needs of twice-exceptional learners. Following IEPs, differentiated assignments are used by 58% of respondents, allowing for the customization of tasks to align with individual learner strengths and areas for growth. Flexible grouping strategy was implemented by 55% of respondents, enabling learners to work in various group configurations based on their skills and needs to foster a dynamic and responsive learning environment. Enrichment activities are also a significant component of the support strategies utilized by 52% of the respondents to provide additional challenges and learning opportunities beyond the standard curriculum (Assouline & Whiteman, 2011).

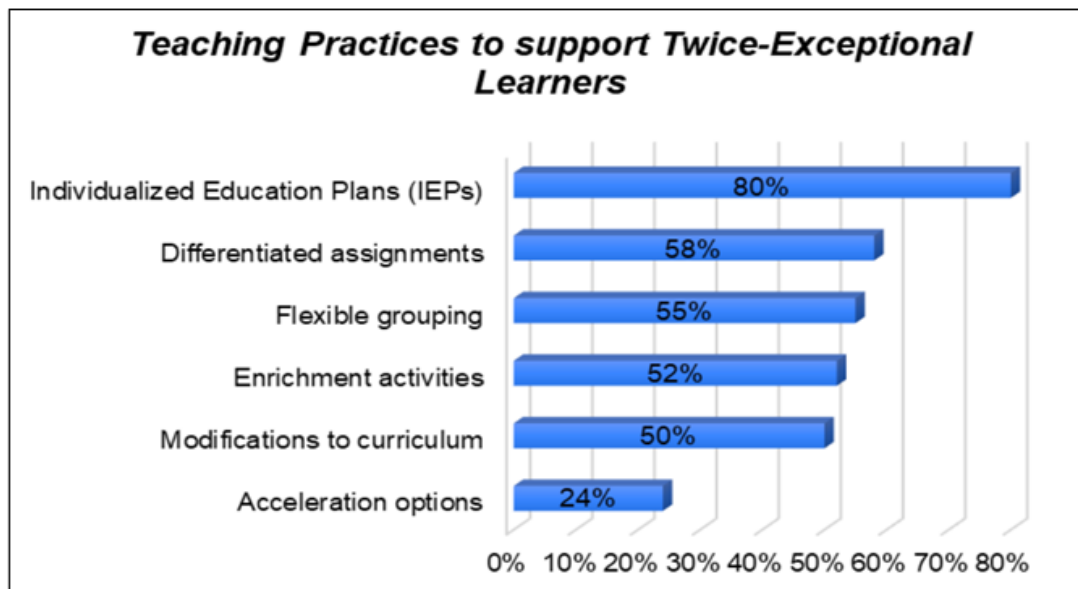


Figure 3: Teaching Practices used to support Twice-exceptional Learners

Modifications to the curriculum with respect to creativity in tasks and implications in the real world are responded by 50% of special educators, indicating a substantial effort to modify the content and delivery methods to better suit twice-exceptional learners (Assouline & Whiteman, 2011). In contrast, acceleration options, which involve advancing learners through education at a faster rate, are the least utilized strategy, with only 24% of respondents incorporating this approach in their teaching-learning process.

Key resources referred by educators for grasping twice-exceptionality

Figure 4 depicts the various resources referred by the special educators for grasping

twice-exceptionality. The most beneficial resource that is expected to provide authentic details according to 59% of educators is with the available documents and materials posted by authors on their websites which include the majority of international data and strategies used by them. Training sessions and/or workshops are also highly valued, with 53% of respondents would like to attend to enhance their understanding of twice-exceptionality. Books or publications on twice-exceptional learners are referenced by 45% of educators, highlighting the importance of literature in professional development.

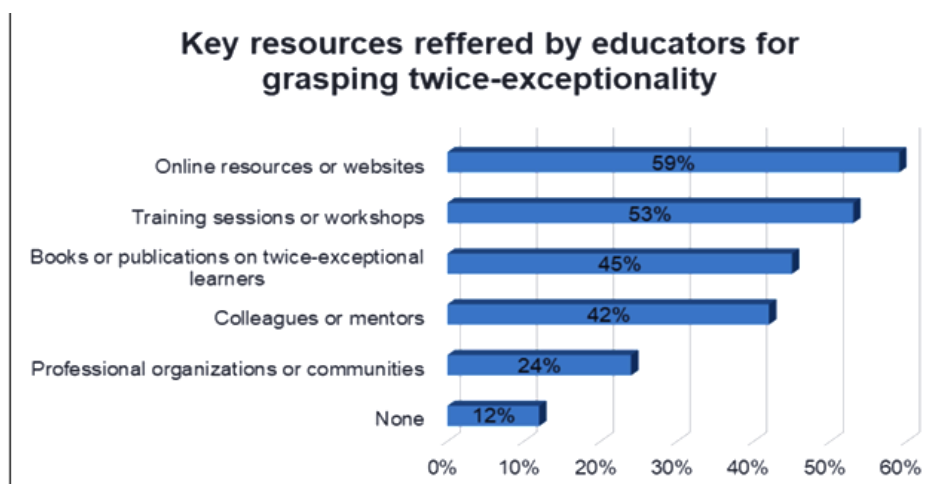


Figure 4. Key resources referred by educators for grasping twice-exceptionality

Additionally, 42% of respondents turn to colleagues or mentors for guidance, underscoring the role of peer support and professional networking. Professional organizations or communities are utilized by 24% of educators, providing a more structured and formal avenue for acquiring knowledge. Interestingly, 12% of respondents reported that they do not use any specific resources or tools to understand twice-exceptional learners, indicating a potential gap in access to or awareness of available resources. This data suggests that while a majority of educators actively seek out a variety of resources to support their understanding, there remains a need to ensure that all educators have access to and are aware of effective tools and professional development opportunities.

The key findings of the study show that most of the special educators in Delhi NCR have heard the term 'twice-exceptional,' although they are not fully sure how to identify such learners in their own classrooms. They are reluctant and feel unprepared to teach such learners due to limited knowledge about the dual exceptionalities and most suitable resources and teaching practices that would help in learners' academic and overall growth.

Professional Development Opportunities for special educators in grasping twice-exceptionality

The respondents of the study were given an opportunity to discuss the absolute need and present demand to grasp more information about twice-exceptionality and how they can be more educated about this condition to help their learners in inclusive schools and classrooms. The respondents of the survey in their open-ended additional section commented in majority to develop a short-term course which is approved by the Rehabilitation Council of India and to provide a standardized manual to understand the appropriate teaching strategies that the special educators can use while observing, identifying, screening, and assessing learners

with dual nature and to help improve the intervention strategies to benefit the learners with dual-exceptional traits. This way, the blueprint of what, why and how about twice-exceptionality can be understood better leading to introducing a theoretical framework for twice-exceptionality (2e) in the Indian context. There is a huge gap in the Indian texts that are available at present as they scarcely talk or acknowledge the aforementioned. Providing counselling and educating parents will require strong core knowledge about the difficulty to help their children to get the right type of assessment and diagnosis for such learners. This would help the stakeholders in school to take care of their children's holistic development by providing them with right strategies and using more suitable teaching practices by the general educators as well as special educators of the school. 30% respondents said that they have never read or learnt about the term 'Twice-exceptionality' during their teacher education or while working. The NEP (2020) talks about gifted curriculum and strategies to be used to help the gifted learners and cater to their diverse and unique learning needs focusing on their strengths. Para 4.43, p.19 of NEP 2020 document under the subhead 'Support for Gifted Students with Special Talents' suggests the development of guidelines for the said students by the institutions like NCERT and NCTE. It also suggests allowing a B Ed. programme with specialisation in the education of gifted children.

The respondents also requested to provide them details of professional development and training that are available to be aware of the twice-exceptionality and how to identify learners in an inclusive school with dual exceptionality traits. There is an urgent need to establish standardised tool to understand and develop better resources for twice-exceptional learners, which is only possible with deep understanding of both the exceptional areas, giftedness and identifying gifted skills in learners and also in identifying the learners' extraordinary

skills in those who are labelled as learning challenged due to the possibility of masking effects as we have understood with the global context. If the learners are at an early stage of development, it will be more suitable for the stakeholders to observe, identify, and intervene better to develop a theory around the real examples and case studies leading to understanding of the term indigenously (Kurup & Dixit, 2016).

Discussion

The study sheds light on the awareness level about 'twice-exceptionality' among the special educators teaching in inclusive schools of Delhi NCR. The majority of educators were aware of the concept of twice-exceptionality and only half of them were aware of the characteristics of twice-exceptional learners in an inclusive classroom which align with studies done by Sansom (2015); and includes the work of Barber & Mueller (2011) and Baum, Cooper, and Neu (2001). About 77% of educators believe that there is an urgent need to learn about the concept of twice-exceptionality to develop new strategies which are suitable for the dual nature of such learners to address their gifted skills as well as learning challenges, this is supported by studies done by Renzulli, 2014; Silverman, 2007; Akar & Akar, 2019; Jung & Hay, 2018. Approximately 70% of the educators have no access to educational resources that cater to the learning demands of the twice-exceptional learners which leads to minimal or no support to such learners and masking of their gifted skills and only the disability is visible to the stakeholders (Khan & Khan, 2023). As articulated by Reis et al. (2022), the twice-exceptional learners best learn with personalized support given and by adequately addressing their strengths using the actual intellectual gifts and minimizing their challenges that may occur due to learning difficulties. This study also support the similar patterns of teaching the learners with twice-exceptional characteristics by using the individualized educational plans (IEP), differentiated

instructions, enrichment activities, and flexible grouping approach. These came out to be the most suitable practices that can help twice-exceptional learners to bring about the positive changes in the academic and behavioural performances, according to experienced special educators working in the field especially in resource room practices (Harry & Klingner, 2022; Dare & Nowicki, 2015). Models given by Gagnè, Sternberg, Renzulli, Thurstone and Spearman confirm this method of teaching and evaluating learners with gifted skills and disabilities in an individual. About 60% of special educators find documents and materials that state differentiated instructions and methods of teaching to twice-exceptional learners inappropriate and thus modify and accommodate each individual learners by focusing on their challenged areas. An array of researches suggest that conventional tests fail to administer the actual giftedness and challenges of such learners leading to misidentification and complete oversight of these learners. Half of the special educators find it valuable and important to attend training programmes and workshops to enhance their knowledge about working with learners with unique areas of giftedness that include performing arts, visual arts, music, etc. along with challenged areas that include academics pertaining to subjects like languages and arithmetic and/or behavioural difficulties. This is supported by research done by Gierczyk & Hornby (2021) and Hamzić & Bećirović (2021) as they support that effective education of twice-exceptional learners completely depends upon the well-prepared teachers having deep understanding of both exceptionalities of the learners. Less than half of the educators have ever referred to resources like books or publications that emphasised on understanding of learners with giftedness, disabilities, and both at the same time. Lee & Ritchotte (2017) support that only regular and continuous upgrading the knowledge about the uniqueness of characters enables the educators to effectively understand the actual needs of such learners.

Limitations of the Study

The research exclusively focused only on the pre-service and in-service special educators in which the perspectives of twice-exceptional children and their parents were not included. The purpose of future studies would incorporate these stakeholder groups to provide a more comprehensive understanding of twice-exceptionality. Furthermore, the study design is cross-sectional, that captures the teacher's awareness at a single point in time. Although both pre-service and in-service teachers were included to broaden the scope, this design does not allow for understanding how awareness or practices evolve over time.

Recommendations

There is a significant need for policy development and advocacy for the awareness and development of standardized resources and tools to raise awareness about twice-exceptionality at the institutional and governmental levels. Policymakers should be encouraged to include requirements pertaining to the learning demands and gaps of twice-exceptional (2e) learners to build the educational policies and frameworks to support learning of 2e learners. Sharing success stories and case studies of twice-exceptional learners can also raise awareness, demonstrating the potential of 2e learners when they receive appropriate support and accommodations. Collaborative efforts among educators, psychologists, and researchers are essential for improving awareness and support for twice-exceptional learners. The incorporation of dynamic assessment and intervention strategies enable the educators to address the dual educational needs of such learners. With the introduction of a new educational framework for twice-exceptionality, there will be gradual increase in the support of the twice-exceptional learners by focusing on the learners' individualized educational plan by ensuring that both their exceptional abilities and disabilities are given equal importance

and consideration. The stakeholders working with such learners including the multidisciplinary teams, parents and families, are encouraged to actively engage in exchanging of resources, building pedagogical strategies, sharing specialized knowledge about 2e characteristics and traits, and help in building professional experiences related to twice-exceptionality by fostering a collaborative and informed approach to support the learning needs of these learners.

There is an urgent need to understand the identifying markers to recognize and support twice-exceptional (2e) learners, that requires a standardized, sequenced, system-level approach to cater to the curriculum, teaching practices and policy making. To begin with, a national definition and framework for twice-exceptionality should be established for schools and curriculum developers to have conceptual clarity that can be used by teachers, schools, parents, and boards. NCERT and Rehabilitation Council of India (RCI) must formalise 2e within the disability domain and define professional competencies for special educators to help them develop model resources and assessment guidelines. Once the foundation is laid, the next step is for the universities, NCTE and teacher education institutions to integrate twice-exceptionality in B.Ed. and M.Ed. general and special education programmes, ensuring that the teachers are trained in dynamic assessment, strength-based-planning and dual differentiation strategies. Parallel to this, CBSE and other boards must operationalise the framework through screening tools, flexible curriculum, accommodations, enrichment models and dynamic assessment and evaluation structures. Schools can initiate pilot programmes partnering with universities and teacher institutes to create diagnostic labs and practicum sites to build a collaborative, informed, sustainable approach to meeting the academic, social-emotional, and creative learning needs of twice-exceptional learners. The concept of thrice exceptionality is also

being worked on by many researchers in the present times and there is a need to work more on it. Thrice exceptionality describes individuals who are gifted, having learning disability and belong to a minority (cultural/ social/ racial/ ethnic/ economic) groups.

Conclusion

This study examined special educators' awareness and teaching practices for twice-exceptional learners in Delhi NCR. The findings of this study reveal that 70% of special educators reported being aware of the term 'twice-exceptionality', however, only 53% demonstrated awareness of the traits of twice-exceptionality, and even a smaller number 42% educators had actually identified such learners in their teaching practice, suggesting that 'awareness' in the field remains largely superficial and disconnected from the real application in the disability/inclusion field. In this context, the term 'awareness' is functioning as a familiarity term rather than professional competence, reflecting that the teacher 'knows the word' and 'its meaning,' however cannot operationalize it in the real classroom practices. The key findings of the study show that most of the special educators in Delhi NCR have heard the term 'twice-exceptional,' although they are not fully sure how to identify such learners in their own classrooms. They are reluctant and feel unprepared to teach such learners due to limited knowledge about the dual exceptionalities and most suitable resources and teaching practices that would help in learners academic and overall growth.

The findings indicated moderate awareness and inconsistent support due to varying resources and training that are presently available and that too in a very limited institution. Several structural factors such as limited institutional resources, absence of screening tools or formal policy, and broader cultural ethos that prioritise remediation of deficits over nurturing the gifted skills result in masking of giftedness and interpretation as behavioural concerns. To address these

gaps, the study recommends enhancing educators' awareness by giving them opportunities to be a part of discussions and workshops, standardizing teaching practices by the head institutions to support the learners with giftedness and learning difficulties in a mainstream school and providing ongoing professional development opportunities to educators. The educators working with such learners need to cater to these learners by making a least restrictive environment to nurture the learners with exceptional characteristics that are usually most challenging in an inclusive educational institution such as curriculum, resources, checklists, or standardized tools for 2e learners. In conclusion, there is an urgent need to address these gaps in disability practices. With the introduction of the National Education Policy (2020), there has been a shift in bringing awareness and discussions for the teaching practices and accommodating learning needs for gifted learners in inclusive setup that directly helps in bringing about the learning needs and addressing the importance of accommodating learners with giftedness and disability at the same time. The improvement in areas of awareness, teaching methods, resources available, and attitudinal change in educators will help to cater to learners with twice-exceptionality in different kinds of institutions of Delhi NCR. Future research must incorporate multi-informant case studies, longitudinal case tracking and tool validation studies to create a strong, structured, and standardized identification system for twice-exceptionality in India, like other disabilities are recognized under the disability act. For practice, the next step would be to develop teacher training modules grounded by dynamic assessment, creating standardized 2e screening checklists, building strong educational resource banks, and piloting school level 2e support frameworks through CBSE, NCERT, and RCI.

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Are Tomorrow's Teachers Ready? Assessing Prospective Teachers' Competency in Implementing Universal Design for Learning in the Classroom

Krishna Kumar Rajak*, Pragya Gupta

Abstract

This study examines prospective teachers' implementation of Universal Design for Learning (UDL) by employing a situational test. Fifty participants were selected for the study. Analysis of data from situational tests is conducted using a rubric, grounded in UDL guiding principles (multiple means of representation, engagement, and expression). Further, the data include 12 prospective teachers for focus group discussion to provide qualitative insights into their UDL practices. The finding showed that 50% of the prospective teachers demonstrated moderate level of competency, that they have basic understanding of what UDL is, 34% of prospective teachers were in the lower range of competency indicating that there are significant difficulties in applying UDL practically, namely, giving specific support to learners and making it accessible and finally 16% in high competency represented strength in implementing UDL in the classroom. Additionally, the t-test revealed that female prospective teachers had higher competency in student engagement (SM) than their male counterparts. Further, the study found a similar level of UDL competency among the prospective teachers of both the B.A. B.Ed. and B.Sc. B.Ed. programmes. Qualitative analysis revealed that the majority of prospective teachers have theoretical knowledge, but they felt challenged while implementing UDL in the diverse classroom. Time constraints, curriculum demand, inadequate resources, large classroom size, and institutional challenges limit the efforts of the prospective teachers to implement UDL in the diverse classroom. Despite these challenges, teachers expressed enthusiasm for UDL practices and emphasized hands-on practice to make UDL a sustainable, impactful approach in diverse classrooms.

Keywords: Prospective Teachers, Universal Design for Learning (UDL), Situational Test, Inclusive Education, Scoring Rubrics.

Introduction

Inclusion is a process that overcomes barriers that limit the presence, participation, and achievement of all learners. It is a matter of the system adjusting to the needs of the learner, not a matter of the learner adjusting to the system (UNICEF, 2014). Inclusive education aims to respond to all students' needs beyond school attendance and achievement while improving all students' well-being and participation (Cerna et al., 2021). Equity and inclusion in education must be encouraged in policymaking to

guarantee human rights and educational, individual, and societal goodwill (Mezzanotte, 2022). Inclusive education improves the quality of learning since it gives learners a child-centred approach, which fulfils the needs of students with diverse needs, leading to improved outcomes for all students. In addition, equitable educational policy allows students to achieve their potential, which has a positive effect on their opportunities (UNESCO, 2020). By 2030, 'Education for All' is the global concern to enjoy equal opportunities and receive quality education irrespective of diverse backgrounds or

disabilities (UNESCO-UNEVOC, 2021). The National Education Policy (NEP) 2020 draft discussed equitable and inclusive education (SDG4) that makes a vision for all learners to access, participate, and achieve a new place in a social diaspora (Bagga & Kaur, 2020). Diversity among learners should be expected, accepted, and respected to promote inclusion in school education. Every learner has his/her own learning style, and the most crucial point in the education system is its limitation within the curriculum and rigidity in teaching-learning practices, which create barriers to learning beyond the limit. Curriculum is the central means for enacting the principles of inclusion and equity within an education system (UNESCO, 2017). To make the curriculum more effective in catering to the needs of diverse learners, teachers have to extend the curriculum and adopt some innovative practices like Universal Design for Learning (UDL).

Universal Design for Learning is a flexible framework to minimize learning barriers and to prevent over-individualizing education and improve opportunities for diverse learners (Sanger & Gleason, 2020; Roski et al., 2024). UDL is universally known, and it has contributed substantially to educational practices due to its emphasis on inclusiveness in diverse situations (Gronseth & Dalton, 2019). These new 3.0 guidelines (CAST, 2024) include specific recommendations that can be applied to any discipline and that will allow learners to be involved in challenging but accessible education processes. COVID-19 exposed the insecurities that were inherent to the school system: overnight, billions of students were transformed into online learning because schools were shut down (Hodges et al., 2020). The transition further increased the impact of the need to establish multi-purpose digital learning environments, which could accommodate a number of student needs, and thus, adhere to the principles of UDL of flexibility and accessibility. The existing literature emphasizes the discrepancy between the theoretical and practical

knowledge of teachers on the UDL knowledge (Smith et al., 2019). While UDL guidelines are well-established, effective teaching modules are not available for teachers to adapt UDL principles in a diverse classroom for implementing the theoretical knowledge into a practical form. According to Al-Azawei, Serenelli, and Lundqvist (2016), the teachers are already acquainted with the main ideas of UDL, like multiple means of representation, engagement, and expression, yet they have a problem with implementing these concepts in flexible classroom activities. Likewise, Spooner et al. (2007) also highlighted the fact that teacher education tends to focus more on conceptual knowledge rather than direct training or mentorships, which in turn makes teachers lack preparedness in the implementation of UDL in different educational settings. Ghosh (2019) reported that in Indian curricula, no university or institution has incorporated UDL in the course curriculum. Furthermore, several studies reported a lack of trained teachers and supporting staff, suggesting adequate training of teachers to develop a consensus to deal with inclusive classrooms (Charema, 2010; Ji, 2019). Moreover, the requirement of instant action to address various needs of a student often overwhelms and intimidates teachers, and they are not sure how to make real-time adjustments because they do not have the skills or experience necessary to do so. According to Forlin and Sin (2010), without the continued training and support networks, the teachers may tend to fall back on the conventional concept of teaching, thereby derailing proper UDL practices.

However, there is a consensus to conduct such professional development training programmes to enhance teachers' theoretical knowledge regarding UDL guiding principles (Melhem & Al-Rashid, 2023). To prepare competent teachers for diverse classrooms, projects like NISTHA and in-service training programmes are organized by NCERT from time to time, and for pre-service teachers, NCTE made the two-credit course of Inclusive Education compulsory in pre-service

training programmes. Despite making lots of efforts to prepare competent teachers to deal with diverse classrooms, teachers are not competent in dealing effectively with diverse learners' needs using UDL. However, there is a need for a possible change in the curriculum that offers a more flexible and practical approach rather than a theoretical approach, which helps teachers to decide and modify the prescribed learning strategies best suited for the individual learner's needs (Joshi, 2020).

Conventional approaches to assessing teacher proficiency on a Likert scale, such as self-reporting surveys (Self-efficacy scale), often fail to adequately measure teachers' competency to implement UDL strategies. So, the written situation-based test finds the theory-practice gap among prospective teachers, recommending the required professional development interventions.

Theoretical Background of UDL

Universal Design for Learning (UDL), which stems from Universal Design, is the "deliberate design of instruction to meet the needs of diverse learners, providing all students with an equal opportunity to learn through flexible approaches, and distinguishing between the desired learning outcome and the means of achieving them." (International Disability Alliance, 2021). UDL focuses on minimising the barriers rather than changing the learners' needs by providing an appropriate learning environment that focuses on the learners' preferred learning style and makes the learning comfortable (CAST, 2018; Fisseler, 2023). Nevertheless, UDL favours every learner, whether impaired or not, and is applied across the curriculum in most countries (Edyburn, 2021). The UDL Guidelines provide practical tools for prospective teachers and researchers to implement UDL principles and guides to develop accessible instructional materials, methods, and assessments (Roski et al., 2024; Tulqin O'g'li et al., 2024). Further, UDL guides prospective teachers to create flexible, better learning experiences that

cater to all learners' needs and preferences (Meyer et al., 2014).

UDL has emerged as a major pedagogical paradigm in the last two decades, seeking to address the conventional 'one size fits all' curriculum by promoting student variability and flexibility in classroom engagement, promoting inclusive education (Bray et al., 2024; Meyer et al., 2014). The Centre for Applied Special Technology (CAST) first developed the framework of Universal Design for Learning (UDL) in 1998, along with a mission to transform educational design for learning with a set of three principles: multiple means of representation where the principle emphasizes providing diverse ways for students to access learning, ensuring they have the choice to suit their learning styles and preferences, multiple means of engagement where UDL emphasises the importance of engaging students through diverse strategies and activities, acknowledging their varied interests and motivators (Sánchez-Cabrero et al., 2024), and multiple means of action and expression where students have choices and flexibility to how they want to demonstrate their learning (Bray et al., 2024). Loreman et al. (2010) suggested that before planning the lesson, prospective teachers must include essential components of must know, should know, and could know in the plan to cater to every individual's needs.

The Emergence of Universal Design for Learning (UDL) as a Framework

India is one of the most diversified countries in the world, where variability among learners needs an inclusive academic environment, but, indeed, lots of prospective teachers still can't understand the needs of the diverse learners to facilitate or promote equitable and quality education for all, and that is why learners hardly cope with the prescribed set of curricula. Misquitta and Joshi (2020) reported that most often, teachers are not aware of such existing digital tools and technologies, so they do not have the skill

to use such technologies effectively in the classroom to assess the learning progress and build engagement among learners with the task. UNESCO's report (2017) on children with special needs in India identified gaps between policies implemented and practice. In Mullick's (2012) interview on universal design, he discussed two problems: India didn't have a lack of information or laws. However, there is a lack of implementation and accountability to meet the policy goals. Odunavar & Kumaraj (2018) reported that prospective teachers have limited knowledge regarding theories and practices of UDL. Worthwhile, we need a shift from the traditional to an accessible curriculum that meets the specific needs of diverse learners and creates accessible resources, materials, and assessments that will provide a more inclusive learning experience for diverse learners. In pursuance of the UDL approach in the classroom, a report from Spooner et al. (2007) states that a brief introduction to the UDL can help teacher educators prepare such lesson plans that will cater to the needs of each learner in the classroom. Furthermore, a study by Capp (2017) examined the effectiveness of using the UDL approach in the classroom through a meta-analysis of the published articles dated between 2013 and 2016, found that using the UDL approach in the classroom revealed positive signs of learning in a better way for diverse learners. However, NEP (2020) stressed multiple aspects of revamping the current schooling structure, radically reforming the existing curriculum, and extensively using digital technologies to provide accessible content and resources in a different format that creates a barrier-free environment for children with special needs. NEP (2020) also stresses the strategic use of digital technologies in the teaching and learning process to maximize learning. However, as per the Guidelines for the Development of e-Content for Children with Disabilities, e-content will continue to be developed in different regional languages

by all states, and NCERT, NIOS, CIET, and CBSE also make efforts to upload such qualitative content on the DIKSHA platform. UNICEF and Partners' Experts conducted a workshop on 'Principles for the Production of Accessible Digital Textbooks (ADTs)' in September 2017 at Gallaudet University. Initially, the aim was to develop specific guidelines for specific disabilities. Further, over time, it evolved to include the UDL approach and, based on that, a prototype of ADTs was developed in Brazil. The 'Learn My Way' reader prototype is a proof of concept that stands on the UDL principles shared by UNICEF and recommends to development of ADTs, supplementary learning material, and sign language videos under the 'standards and guidelines for the development ADTs for all' to promote inclusion (Section 10, Guidelines for the Development of e-Content for Children with Disabilities, 2021). To cherish accessibility among learners with and without disabilities, UNICEF launched initiatives to bring together writers, publishers, teachers, organizations of persons with disabilities, technologists, and Ministry of Education representatives collaboratively to develop standards and guidelines for producing textbooks in an accessible digital format. This ADT initiative's goal is to improve access to education and create support for all learners (UNICEF for Every Child, 75th anniversary global effort).

Rationale of the Study

In the contemporary classroom, where the values of diversity and inclusion have been embraced, the prospective teacher is required to move beyond one-size-fits-all teaching to use inclusive teaching practices that can accommodate individual nuances of the diverse learners. Universal Design of Learning (UDL) is a research-based framework that deals with this changing context by embracing flexibility using multiple ways of representation, engagement, and expression (CAST, 2018).

Although the theoretical basis of UDL is well-known, many prospective teachers do not recognize UDL, and, in the absence of gaps in theoretical knowledge, the implementation of the principles into a dynamic learning environment may prove a challenging task (Bedir, 2022; Phelan, 2025).

Numerous studies have already been conducted on teachers' views (Bedir, 2022), teachers' perceptions (Melhem & Rashid, 2023; Fuentes et al., 2016), teachers' knowledge (Mavrovic-Glaser, 2017), and awareness towards UDL (Dempsey et al., 2023). Moreover, other studies were conducted on UDL-based review papers (Ferreira & Castro, 2024; Phelan, 2025) and UDL-based teaching practices on students' creativity skills (Ahmad et al., 2025). However, several studies have been conducted on situational judgement tests (Weekley & Jones, 1999; Whetzel & McDaniel, 2009; Webster et al., 2020), video-based situational judgement tests (Weekley & Jones, 1997).

However, research suggests that there is always a gap between their theoretical understanding of UDL and its actual practice, mainly because of a lack of adequate practice-based training, contextualized materials, and evaluation that does not reflect the real-life teaching situations. This study attempts to solve the research problems through the development and assessment of a situational test mirroring real-life classroom situations endorsing UDL standards. This research will determine the capacity of the prospective teachers to work with UDL in the classroom, which will provide ideas to design programmed

professional development and adjust policy schemes to implement changes based on teaching UDL effectively.

Research Objectives

1. To assess the competency level of prospective teachers in applying Universal Design for Learning in the classroom.
2. To identify the challenges encountered by prospective teachers in applying UDL in the classroom and explore their reflective suggestions for improvement.

Methodology of the Study

Methods

The study used an Exploratory Sequential Mixed Methods design. In the quantitative phase, the study used situational tests to explore and understand how prospective teachers perceive and apply UDL in diverse classrooms. Further, in the qualitative phase, researchers conducted focus-group discussions to provide insights into their UDL practices.

Participants

A total of 50 prospective teachers from the B.A. B.Ed. and B.Sc. B.Ed. programmes (VIIth semester) of the Teacher Education Department, Central University of South Bihar, were selected using purposive sampling for the situational test analysis. Additionally, 12 participants were randomly selected from three pedagogy groups (Language, Social Science, and Science) for a focus-group discussion to provide qualitative insights into their UDL practices.

Table 1: Details of the participants

Programme	Total no. of participants	No. of participants	
		Male	Female
B.Sc. B.Ed.	26	12	14
B.A. B.Ed.	24	16	8

Instrument

The data collection tool was Situational Test and Focus Group Discussion (FGDs). Situational test recreates the real situation in the classroom and evaluate the ability to solve problems in an adaptive way as well as to show the gaps in training (Pisha & Coyne, 2001; Lievens & Sackett, 2017). The situational test item had various scenarios of learners with varying abilities, which were aimed at gathering insights into whether the prospective teacher can apply UDL or not. These types of methods can not only reflect the fits and starts of real-world implementation of UDL, but they also offer a clear measurement of where there are skill gaps that necessitate interventions in professional development.

To assess the competency of prospective teachers, a rubric was developed to analyse the response based on performance criteria: Differentiated Instructional Materials (DIM), Different Levels of Content (DLC), Student Engagement (SE), Integration of Assistive Technology (IAT), and Differentiated Assessment (DA) aligned with UDL guiding principles. The performance criteria were assessed on a 5-point rating scale (Excellent/5, Good/4, Average/3, Below average/2, Unacceptable/1).

Furthermore, in consistency with the situational test, the study conducted a focus group discussion (FGD) to explore prospective teachers' first-hand experiences, perspectives, and challenges, and areas for improvement while integrating UDL practices.

Intra-rater Reliability

To determine the reliability of the rubric-based assessment, two raters were used in calculating the Cohen Kappa. These resulted because of adding small differences. A score of 0.61 indicates the existence of significant agreement between the raters, which means that the use of

different evaluators using the rubric will lead to similar and reliable results.

Procedure of Data Collection

Permission for the study was obtained from the Head of the Teacher Education Department at the concerned School of Education. After securing approval, the researcher scheduled the test sessions with the consent of the participants. Data was initially collected through a face-to-face mode. Besides this, participants were invited to be part of the situational test, and they could withdraw from the study at any time, even during the test. During the test, 50% of the participants left before completing the test. So, the remaining half is being used for analysis. Before the test, the researcher provided all necessary instructions. The test had a one-hour time limit. After completion, responses were evaluated using a rubric, and the resulting data were analysed quantitatively.

In the second phase of the study, a focus group discussion was conducted. Twelve participants, six from the B.Sc. B.Ed. and six from the B.A. B.Ed. took part. For the smooth conduct of the session, the FGD was scheduled for the next day. The data obtained from the FGD were analysed using thematic analysis.

Data Analysis and Interpretation

Phase 1: Quantitative Analysis

Descriptive statistics such as mean, SD, skewness, and kurtosis were used to determine the appropriate statistical methods for further analysis and data interpretation. Table 2 presents the descriptive statistics of the UDL competency scores for the 50 prospective teachers, including the mean (2.04), SD (.603), skewness (.441), and kurtosis (.377). As indicated, the skewness and kurtosis values are not ideal values expected for a Normal Probability Curve (NPC).

Table 2: Descriptive statistics of the study

Variables	N	Min	Max	Mean	Median	SD	Skewness	Kurtosis
DIM	50	1	4	2.66	3	.798	-.551	.031
DLC	50	1	3	1.34	1	.688	1.782	1.638
SE	50	1	4	2.30	2	.814	.094	-.457
IAD	50	1	4	1.78	2	.679	.709	1.099
DA	50	1	4	2.12	2	.849	.181	-.770
TOTAL	50	1	3.8	2.04	2	.603	.441	.377

The descriptive statistics of the present study indicate a non-normal distribution, as evidenced skewness and kurtosis values are not close to the ideal value, suggesting the data were neither too flat nor too peaked. Therefore, the use of

non-parametric statistics was employed, with the Mann-Whitney U-test serving as the better alternative to the independent samples t-test. The Statistical Package for the Social Sciences (SPSS, version 20) was used to analyse the data.

Table 3: Result of Mann-Whitney U-test to assess the competency of prospective teachers to apply UDL between Genders (df=48)

Performance criteria	Gender	N	Mean Rank	Rank Sum	U	z	p value	Decision
DIM	Male	28	23.73	664.50	258.50	-1.07	p > .05	NS
	Female	22	27.75	610.50				
DLC	Male	28	23.34	653.50	247.50	-1.63	p > .05	NS
	Female	22	28.25	621.50				
SE	Male	28	21.52	602.50	196.50	-2.33	p < .05	S
	Female	22	30.57	672.50				
IAD	Male	28	22.43	628.00	222.00	-1.89	p > .05	NS
	Female	22	29.41	647.00				
DA	Male	28	22.61	633.00	227.00	-1.67	p > .05	NS
	Female	22	29.18	642.00				
TOTAL	Male	28	21.82	611.00	205.00	-2.02	p < .05	S
	Female	22	30.18	664.00				

As shown in Table 3, the Mann-Whitney U test value ($z = -2.33$; $p < .05$; $df = 48$) revealed a statistically significant difference in UDL competency between female and male prospective teachers in the performance criteria of student engagement (SE). In

particular, UDL competency was proved to be much higher in the case of females as compared to males. Moreover, in total scores of UDL competency proved higher among female prospective teachers as compared to male.

Table 4: Result of the Mann-Whitney U-test to assess the competency of prospective teachers to apply UDL (Programme)

Performance criteria	Programme	N	Mean Rank	Ranks sum	U	Z	p value	Decision
DIM	B.Sc. B.Ed.	26	25.69	668.00	307.00	-.10	p > .05	NS
	B.A. B.Ed.	24	25.29	607.00				
DLC	B.Sc. B.Ed.	26	25.92	674.00	301.00	-.29	p > .05	NS
	B.A. B.Ed.	24	25.04	601.00				
SE	B.Sc. B.Ed.	26	27.73	721.00	254.00	-1.20	p > .05	NS
	B.A. B.Ed.	24	23.08	554.00				
IAD	B.Sc. B.Ed.	26	26.88	699.00	276.00	-.78	p > .05	NS
	B.A. B.Ed.	24	24.00	576.00				
DA	B.Sc. B.Ed.	26	25.10	652.50	301.50	-.21	p > .05	NS
	B.A. B.Ed.	24	25.94	622.50				
TOTAL	B.Sc. B.Ed.	26	26.33	684.50	290.50	-.42	p > .05	NS
	B.A. B.Ed.	24	24.60	590.50				

As shown in Table 4, the 'U' test value ($z = -.10, -.29, -1.20, -.78, -.21, -.42$; $df=48$; $p > .05$) revealed no statistically significant differences in UDL competency scores between B.Sc. B.Ed. and B.A. B.Ed. prospective teachers across all performance

criteria. The results indicate no statistically significant difference in UDL application competency between B.Sc. B.Ed. and B.A. B.Ed. prospective teachers, suggesting a similar level of competency in applying UDL in diverse classrooms.

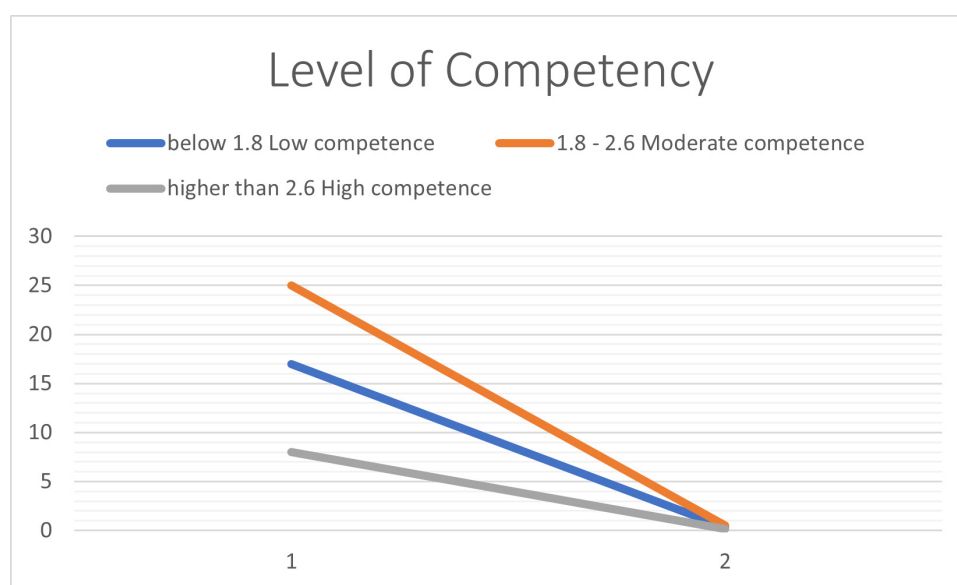


Figure 1: UDL Competency Score distribution

- **Low competence (Score < 1.8):** Seventeen prospective teachers (34%) rated lower in terms of competency, indicating a large number of difficulties in applying UDL in reality, they exhibit minimal effort to design an instructional plan, assessment plan and lack integration of assistive technology, learning resources, create barriers towards accessibility to resources and other measures of the UDL principles.
- **Moderate competence (1.8 - 2.6):** Twenty-five prospective teachers (50%) exhibited moderate competence, possessing limited theoretical knowledge of UDL principles as applied, and lacked experience to integrate ICT or multi-modalities of representations. They somehow engage students but face challenges due to a lack of experience handling diverse learners, and use limited assessment strategies, considering the diverse needs to assess the learners' academic performance.
- **High competence (Score > 2.6):** Eight prospective teachers (16%) exhibited a high level of competency, and it should be noted that there are strengths in the instructional strategies, representation of multiple learning resources, as well as a preference for flexible learning and assessment that address the diverse needs of learners. Such high-performing teachers were strong in adaptations of lesson plans and utilization of adaptive tools to address the needs of various learners.

Though effective UDL implementation can be found among some prospective teachers, the results identify the need for the overall professional development of the prospective teachers beyond mere specific training, interactive workshops, and reflective practice sessions to improve the overall teacher preparedness. Putting more emphasis on scenario-based training, which is applied, might assist in bridging the gap between theoretical knowledge and the implementation of classroom practices that are not provided at the time.

Phase 2: Qualitative Analysis

Theme 1: Awareness of UDL

Almost all the prospective teachers had varied perceptions of UDL. Some referred to it as a flexible teaching method that fits all categories of learners, whereas others witnessed it as a method of making learning easy by giving several ways of representation, engagement, and expression. One participant quoted, as an example, "UDL as giving students options, such as allowing them to write or draw answers." One of the participants further contributed by saying that it is related to planning in such a way that all students have access to the content. Some prospective teachers stated that they were not very familiar with UDL, but they implemented some of its strategies naturally without realizing it.

The answers were mixed when it came to the level of confidence in implementing UDL. One of the participants (a teacher of mathematics) answered the question in the following way: "I am confident in the content knowledge, but I do not have the strategies that help to make mathematics lessons more accessible to diverse needs students." Most of them demonstrated moderate levels of confidence as they admitted that they knew the concepts, but real classroom performance was difficult, especially when they had to prioritize time, follow the curriculum, and manage huge classes. Others confessed that they were just beginning to implement UDL and, therefore, more resources, planning, and assistance were necessary to feel comfortable. Altogether, in total, the motive of implementing UDL was strong, and it was clear that there is a need to enhance training, practical materials, and institutional provision.

Theme 2: Inclusive Practices of UDL

When presented with the question of providing an example of a UDL strategy, many participants shared positive experiences. As an example, some of them stated that

they used visual aids, flexible teamwork, and choice-based tasks to involve diverse learners. According to one participant, “I would give students a choice to write an essay or create a poster - it builds their confidence.” Nevertheless, some participants confessed that they had difficulties in implementing UDL. One of them said: “I feel like providing choices, but there is not enough time and resources.” One of the other participants explained, “I do not know how to differentiate without knowledge.”

On the effects of UDL in relation to student participation and engagement, many of the participants indicated the benefits of UDL in improving the participation of the students. As an illustration, one of the participants said, “When I offered them choices in the way they could share their work, either by using videos, making posters, or writing them in a report format, they were more interested and motivated.” Another exclaimed, “Visuals and hands-on tools made my shy students feel freer to contribute.” But there were also difficulties described: “I attempt to provide choices, but in big classes it is difficult to control.” The other participant said that he finds it challenging to accommodate multiple needs with fewer resources. Overall, even though UDL promoted engagement, its effective implementation required assistance, planning time, and a small class size.

Theme 3: Challenges in Using UDL for Diverse Learners

When discussing the main challenges in the implementation of the UDL principles, many participants mentioned such barriers as a lack of training, time, and resources. One participant said, “She wanted to implement UDL, but strict curriculum guidelines and large classes make it difficult for her.” Some of them stated that they needed additional institutional support and collaborative planning to implement UDL effectively in the classroom. Also, others pointed out the lack of administrative support or appreciation, which made their work seem lonely or unsustainable. Overall, they found it hard

to balance UDL with traditional teaching demands, especially in large classes.

The majority of the participants identified time constraints, rigid curriculum, and lack of resources as key barriers to using UDL. Some have made a short attempt to incorporate easy UDL techniques despite the busy schedules, like viewing short videos or providing choices of assignments. However, it was widely observed that highly demanding curricula and few tools make implementation difficult. One teacher said, “I want to offer different ways to engage students, but we don’t have projectors or internet,” while another added, “I don’t have enough time to personalize content for each student.”

Theme 4: Reflections and Suggestions

The participants stressed that school leaders and policymakers should support UDL implementation strongly and on a consistent basis. They suggested that regular training, access to resources, and reduced workload would help. Although workshops came in handy, participants emphasized the necessity of constant assistance, technology tools, and teaching supplies. They also highlighted the importance of collaboration time for co-planning, saying it makes UDL more manageable. Many wanted UDL to be included in school policies and assessments, and hoped leaders would model inclusive practices. Overall, teachers called for reliable, long-term support to sustain UDL in their classrooms.

Participants shared practical and encouraging guidance for new teachers adopting UDL. They suggested beginning with small steps, such as offering different ways for students to interact with content using visuals, hands-on activities, or digital tools, and emphasized the importance of first understanding each student’s strengths and needs. One participant said, “I always provide assignment choices like posters, presentations, or essays,” while another encouraged the teachers to “experiment and adjust.” Collaboration with colleagues,

ongoing professional growth, and reflecting on student feedback were also recommended. Overall, they emphasized that minor modifications under UDL could contribute to the development of much higher levels of involvement and acquisition in diverse classrooms, where flexibility and choice should be essential.

Discussion and Conclusion

This study examined the UDL competency of prospective teachers in terms of their theoretical knowledge level, practicum knowledge, real-life implementation obstacles and access to sources of support. The study revealed that the female prospective teachers have a higher level of competency in student management (SM) than their male counterparts. Furthermore, a similar level of competency was found among B.A. B.Ed. and B.Sc. B.Ed. students. Prospective teachers mean both programmes have a similar level of UDL competency. Results reveal that the prospective teachers of both programmes have a superficial understanding of UDL principles and practical knowledge. The study found a theory-practice gap within the institution. The institutional challenges remain because prospective teachers first visit the school internship programme (SIP) before the theoretical and practical exposure to inclusive education. Besides, the curriculum of inclusive education reveals that they have the provision to visit special schools for observing the behaviour of the diverse students and their needs, but the university does not take any efforts to provide exposure to inclusive curriculum-adapted schools or special schools. Therefore, this indicates the institutional flaws that affect the alignment between curriculum instructions and practical implementation.

The results of the study reflect the complex challenges faced by prospective teachers relative to the introduction of Universal Design for Learning (UDL) in real classrooms. The situational test and focus group responses indicated both systemic and skill-based

barriers. The biggest challenge identified is that prospective teachers have a basic level of awareness and content knowledge but fail to implement UDL because they lack the pedagogical knowledge and skills to teach diverse types of learners. In line with the present study, Bedir (2022) revealed the lack of conceptual knowledge about UDL among the prospective teachers. Although many teachers had heard of UDL, few teachers demonstrated deep knowledge of its core principles or knew how to transform them into everyday teaching. This shortcoming is reflected in the past studies that indicate that although UDL is philosophically acceptable at the theoretical level, at the practice level, it has been widely accepted erroneously (Rao, Ok, & Bryant, 2014). There were also problems regarding the ability to reconcile curriculum requirements with the free play of UDL, which has been found earlier in studies that tried to uncover tensions in inclusive pedagogies in the standardized educational apparatus (Edyburn, 2010).

The study revealed few prospective teachers consistently reported that they somehow practice in the domain of multiple means of expression. They further stated that they offer multiple means of expression, but it takes significant time to assess due to the large class size. However, prospective teachers' abilities were restricted to accommodate diverse learners' needs due to the large class size. Additionally, they face significant challenges while designing UDL because of the time-consuming and often impractical with the given existing workloads (Katz & Sugden, 2013). This limitation was further aggravated by the lack of availability of resources and technology, especially in under-resourced schools, which hampered the possibility of teachers applying UDL successfully (Al-Azawei et al., 2016).

The shortage in skills of the teachers and the lack of resources could be found in the realms of assessment design, technology integration, and proactive anticipating the variability of the learners. There was a preponderance of reactive planning, instead of proactive,

as teachers attempted to respond to the needs of students, resulting in the need to have a long-term process of professional learning and action in place. Contrarily, when conducting situational tests and FGD, different levels of competency counts were observed, and some teachers prospered on adapting planning, and others failed, demonstrating the necessity of scenario-based tests as suggested by Basham et al. (2020). According to Spooner et al. (2007), successful UDL training requires more than a workshop held to learn theory; it should proceed to the next level (practicum or scenario-based workshop).

Although aspiring teachers show a great desire to adopt UDL, their competency is constrained due to the three elements, i.e., pedagogical knowledge, resource factor and the institutional factor. To address such

constraints, teacher education curricula should focus more on practical experience of teacher-in-training before entering the school internship programme, in line with Meo (2008) advocating reflective iterative training that liberates teachers so that they become flexible in integrating strategies of UDL across the learning experience of different learners. Teachers are also required to instil a good inclusive practices culture, and therefore, school leadership and teacher education institutions must create the time, resources and recognition needed to achieve this. The prospective policies must be directed to empower those who are going to become teachers by providing scaffold training and offering tools and assistive technologies that can be adapted. It is only in this case that UDL can transition to generalizable and lasting classroom work.

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Supervision that Speaks: Understanding Feedback Practices during School Internship

Niharika Das*, Yeasmin Sultana

Abstract

The school internship in teacher education acts as a crucial bridge between theoretical coursework and actual classroom practice. Central to this transitional phase, the role of supervisory feedback significantly influences the professional development of student teachers. The present study, therefore, sought to investigate the nature and frequency of interactions between university supervisors and student teachers before, during, and after classroom teaching sessions, examine how student teachers implement supervisory feedback into their practice, identify challenges faced in the feedback process, and ultimately offer suggestions to make feedback practices more effective during the school internship through a mixed method research design. The quantitative data were collected through questionnaires, which were administered to student teachers, while qualitative insights were gathered through semi-structured interviews with a smaller sample of student teachers from the two-year B.Ed. programme of Tezpur University, Assam. The findings of the study indicate that although an important developmental role is played by the supervisory feedback, its effectiveness is largely dependent on its clarity, timeliness, relevance, and the nature of the interaction between the supervisor and the student teachers. Significant barriers to feedback implementation that emerged during the analysis were unclear and delayed feedback and lack of follow-up. The need for more collaborative, specific, and reflective feedback, supported by modelling suggestions and consistent mentoring, was therefore emphasized by the student teachers. The study calls for more structured, empathetic, and responsive feedback practices that align with the developmental needs of student teachers and foster their growth as reflective and competent educators.

Keywords: Supervisory feedback, Student teachers, Supervisor, School internship.

Introduction

The National Curriculum Framework for School Education (NCFSE) 2023 aims to provide meaningful classroom experiences and value-based instruction to the students, which marks the importance of recognizing that need of qualified and competent teachers enough to fulfil the needs of today's students. So, here comes the need of teacher education. It has been documented that teacher education and professional development programmes play a crucial role in tailoring the future

of education by contributing extensively to the changes in teachers' knowledge, practice, skills, and competencies required to navigate the complexities of the classroom environment (van Driel, 2014). Today, in the field of teacher education, there is a greater focus on the importance of teaching practicum as a learning environment for student teachers (Mantle-Bromley, 2003; Smith, 2003). Hamalik (2005) proclaims that 'school internship' is a series of activities that is programmed for the student teachers, comprising learning to teach or learning outside the teaching activity itself, which

provides a chance to develop the professional competencies required by the work field of teachers or other educational personnel. School internship is, therefore, a pivotal professional development component which considerably influences the knowledge and practice of the student teachers (Hodges & Hodge, 2017; Lawson et al., 2015; Wilson et al., 2001; Koşar, 2022). This is because school internship is the melting pot, where all the knowledge and skills obtained by the student teachers during training are integrated into the classroom environment. Through school internship the developmental journey from being novice teachers to becoming experts in a real classroom setting is commenced by the student teachers. Afolabi (1999) & Darling-Hammond (2010) argued that school internship prepares the student teachers to orient with the practical knowledge of teaching and learning processes comprising lesson plan preparation, presentation, class management, communication skills, evaluation, as well as the required personality of professional teachers. School internship occurs in a social context; other than the university supervisor, the cooperating teacher, school administration, and students are also among the social agents that make the practicum experience a positive one (Omilani & Ogbonna, 2023). The NCTE, through its 2016 guidelines, has also emphasized the significance of school internship in the preparation of competent and reflective educators. According to NCTE (2016), the 'school internship' is an essential component of teacher education programme, requiring a minimum of 20 weeks of engagement in a school setting, intended to provide the student teachers with hands-on experience, enabling them to integrate and apply their theoretical knowledge in real-world classroom environments, and to foster a gradual transition from learners to teachers, allowing them to gain confidence and proficiency under the supervision of experienced educators. Supervision is a necessary and vital component of the teaching practice (Mohanty, 1987; Lindstrom et al., 2022; Wainman, 2011; Hunn, 2009).

The concept of supervision is based on the assumption that the student teacher is a novice, and he/she requires guidance and feedback from an expert, i.e., a supervisor; generally, a staff member from a teacher education institution (Mohanty, 1987). It is based on a collaborative relationship between the faculty supervisor and the student teachers, which fosters the development of professional competencies and identity (Cooper et al., 2010) and it encompasses a range of activities aimed at enhancing teaching effectiveness through observation, feedback, and reflection on practice (Burns et al., 2016b). The faculty supervisors provide student teachers with guidance as well as constructive feedback to enhance knowledge and confidence in teaching (Baeten & Simons, 2016; Al-Mekhlafi & Naji, 2013).

Supervisory Feedback

The practice-based curriculum during school internship provides the student teachers with myriad possibilities to draw insights about teaching practice (Amador, 2017; Davis et al., 2017; Dotger et al., 2018; Wang et al., 2019). In such a curriculum, feedback from supervisors is integral for enriching student teachers' learning as well as for modelling what they will have to do as practising teachers (Hattie & Clarke, 2018; Sayeski et al., 2019; Torres et al., 2020; Adalberon, 2021). The inclusion of feedback on practical performance promotes precise development of the pedagogical skills. In these cases, the feedback must be specific and associated to student teachers' performance in each assessment task, breaking down the practice into components for targeted feedback (Sayeski et al., 2019; Bien et al., 2018; Adalberon, 2021). The supervisor, therefore, must create an optimal classroom climate and have a deep understanding of the content being taught (Hattie & Timperley, 2007). In a profession dedicated to teaching, the experience of receiving reliable and appreciative feedback not only promotes learning but also boosts engagement (Rodger et al., 2011). According

to Omilani & Ogbonna (2023), the supervisor is expected to give immediate oral as well as written feedback to student teachers. The written feedback is noted in the student teachers' internship lesson notebook, and the oral feedback given by the supervisor provides a detailed explanation on the written feedback. Morton and Kurtz (1980) asserted that during supervision, the feedback provided is a form of instruction showing the supervisee's deficit resulting from a lack of teaching knowledge or skills based on the supervisor's observation. Therefore, the judgement of the supervisors concerning the internship performance of the student teachers determines the adjustments they make to their knowledge and practice during internship, among other things. Thus, the supervisor plays a lead role in professional development compared to the other social agents involved (Omilani & Ogbonna, 2023). Feedback is one of the most powerful instructional interventions educators can use to help student teachers increase their knowledge and skills (Hattie, 2009). Smith (2010) stressed that student teachers generally wanted feedback on the overall quality of their lessons and practical recommendations on how to refine their performance. Similarly, Akkuzu (2014) has pointed out that feedback is a vital informative practice allowing student teachers to view their teaching performance critically and as a means of enhancing their own teaching performance and style of presentation. Numerous reviews and meta-analyses have indicated that feedback has the potential to enhance student teachers' performance and learning (Black & Wiliam, 1998; Kluger & DeNisi, 1996; Hattie & Timperley, 2007; Shute, 2008; Evans, 2013; Li & DeLuca, 2014; Winstone et al., 2017; Wisniewski et al., 2020).

Literature Review

The interaction between student teachers and their supervisors plays a vital role in shaping the practicum experience. White (2007), found that student teachers engaged

in multiple feedback interactions – after classroom observation, mid-placement, during debriefs, and after assignments – revealing that regular and staged feedback remarkably supports professional learning. These sessions were found to be more fruitful by the student teachers when the feedbacks were specific, spoken, and aligned with their teaching practices. According to White (2007) and Kushwaha (2014), clear, prescriptive, and practical feedback is the most beneficial for future teachers. Al-Malki et al. (2020) stated that inconsistent feedback practices across institutions in Oman, made student teachers desire greater uniformity and agency in feedback interactions. Similarly, Yuan et al. (2024) investigated about how student teachers deal with the negative feedback they receive during practicum. Guiding the study with the feedback literacy framework, the researchers revealed that while feedback often provoked emotional discomfort among the student teachers, many of them developed internal coping mechanisms like emotional regulation and reflective acceptance, illustrating how complex a feedback experience might be. Omilani & Ogbonna (2023) found that written supervisory feedback in science education is often provided in a general way and lacks subject-specific direction. Majority of the comments pointed towards the use of general pedagogical knowledge rather than pedagogical content knowledge (PCK), limiting its usefulness in refining discipline-specific teaching practices. Hence, the absence of specificity in feedback resulted in missed opportunities for learning among student teachers. Whereas existing studies have examined various aspects of feedback during pre-service teacher education such as the forms, perceptions, and effects of feedback; there remains a lack of comprehensive understanding on how supervisor-student teacher interactions takes place specifically before, during, and after the classroom teaching, along with exploring how student teachers implement feedback after receiving it from their supervisors into their teaching practices. The challenges faced by the student

teachers in understanding and implementing feedback are often mentioned in literatures but not explored in detail. In addition, practical, evidence-based recommendations for increasing the effectiveness of feedback during school internships remain scattered and underdeveloped in the literatures. This study, therefore, seeks to address these gaps by providing a holistic examination of the feedback practices, their implementation, associated challenges and suggestions for improvement in the context of school internship programmes.

Hence, this paper attempts to address the primary research question: 'How do supervisory feedback practices shape the experiences and teaching practices of student teachers during the school internship?'

For answering the above question, the following objectives have been framed:

1. To examine the frequency of interaction between supervisors and student teachers before, during and after classroom teaching sessions during the school internship.

2. To assess how the student teachers implement the feedback into their teaching practices during the school internship.
3. To identify the challenges faced by the student teachers regarding the feedback they receive from supervisors during the school internship.
4. To provide suggestions for making feedback practices more effective during the school internship.

Research Methodology

Research Design: In the present study, the mixed method (QUAN + QUAL) research design was employed. The convergent parallel research design where both quantitative data (through questionnaires) and qualitative data (through semi-structured interviews) were collected simultaneously to acquire a clearer picture for the study in question. The figure below shows the research design adopted for the present study.

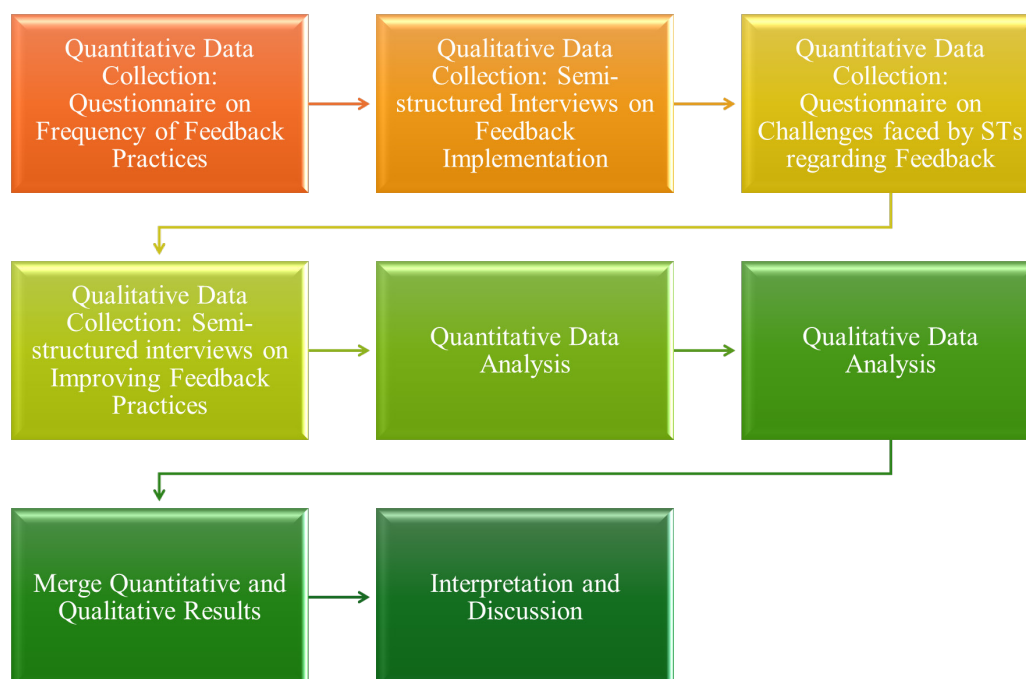


Fig 1: Convergent Parallel Mixed-Method Research Design

Sample: For the quantitative phase, the study targeted the entire cohort of 63 student teachers enrolled in the class of the two-year B.Ed. programme of Tezpur University who have completed their internship during the academic year 2024-25, adopting a total population sampling approach. Since participation was voluntary, out of 63 only 50 student teachers responded in completing the questionnaire. Therefore, the final sample reflects a voluntary response form of non-probability sampling, as only those who chose to participate were included as the respondents (sample). Additionally, for the

qualitative phase, a total of 10 student teachers were purposively selected from the quantitative group.

Analysis

Objective 1: To examine the frequency of interaction between supervisors and student teachers before, during and after classroom teaching sessions during the school internship.

Table 1 highlights the emerging themes that turned up from the analysis of the data being collected through questionnaires from the student teachers (N=50).

Table 1: Interaction between supervisors and student teachers before classroom teaching session

Occurrence of Pre-Observation Interaction			
Statement	Percentage of Respondents		Interpretation
Whether student teachers had any interaction with supervisors before their classroom observation?	Yes	64%	Findings indicate that pre-observation interactions with supervisors were experienced by the majority of student teachers. However, a significant minority of student teachers lacked such interactions, which illuminates a space for more consistent supervisory engagement.
	No	36%	
Aspects discussed during the Pre-Observation Interaction			
Aspects	Percentage of Respondents		Interpretation
Expectations for the class	21.8%		The respondents who interacted with the supervisors prior to the classroom observations were asked about the aspects they discussed. Key elements of the discussion included the expectations for the class, lesson planning, emotional support and a continuum of feedback, suggesting that both the cognitive and emotional needs of student teachers were addressed by the supervisors.
Lesson planning	21.8%		
Emotional support or motivation	31.4%		
Feedback on previous class	25%		
Communication style of supervisors during Pre-Observation Interaction			
Communication Styles	Percentage of Respondents		Interpretation
Collaborative	68.8%		The recurring communication style for the supervisors during pre-observation interactions was found to be collaborative, focusing primarily on shared decision-making, joint problem solving and mutual feedback between the supervisor and the student teachers.
Directive	25%		
Non-Directive	6.2%		

Influence on Class Preparation due to the Pre-Observation Interaction		
Influence on Class Preparation	Percentage of Respondents	Interpretation
Boosted confidence and preparation	20 out of 32 respondents involved in pre-observation interaction (62.5%)	A close relationship between pre-observation interaction and improvements in emotional and classroom readiness is demonstrated by the findings. Also, it was found that the absence of pre-observation interaction negatively affected the student teachers preparation for the class.
No guidance led to anxiety and uncertainty	18 respondents with no pre-observation interaction (36%)	

The findings, therefore, illuminate the fundamental role of interactions between the supervisors and student teachers before classroom teaching sessions, aiding student teachers' preparedness and confidence during school internship. While most student teachers stated about being benefited from such interactions, the absence of it revealed inconsistencies in supervisory practices. Where interactions took place, supervisors not only guided lesson planning and clarified expectations but also offered emotional

reassurance, exhibiting that supervision extended beyond technical aspects to address affective needs. Additionally, the collaborative style of communication emerged as a supportive supervisory approach that fostered trust and professional growth. Hence, it is believed that interactions before classroom teaching sessions remarkably enhance both the emotional readiness as well as classroom performance of student teachers, while its absence can make the student teachers feeling less prepared and confident.

Table 2: Interaction between supervisors and student teachers during classroom teaching session

Supervisory involvement during Class Observation			
Supervisory involvement during Class Observation	Percentage of Respondents		Interpretation
Very attentive (watching, taking notes)	80%		Supervisory involvement during classroom observations was substantial as indicated by the findings. This suggests that most supervisors pursued observational roles seriously and visibly, whereas a minority of student teachers still experienced limited engagement on the part of the supervisor during their class observations.
Observed sometimes (took notes occasionally)	4%		
Not very involved	16%		
Support Offered by Supervisors during the Class Observation			
Statement	Percentage of Respondents		Interpretation
Did your supervisor offer any support during the class observation?	Yes	(66%)	From the analysis, it is believed that 66% of the student teachers received some form of support while 34% of the student teachers lacked any such support from their supervisor during their class observation.
	No	(34%)	

Forms of Support Offered by Supervisors during the Class Observation		
Forms of Support Offered during the Class Observation	Percentage of Respondents	Interpretation
Direct Support (Helped with teaching methods, managing the class, etc.)	63.7%	It appears that majority of the student teachers indicated about receiving some form of support from their supervisors during their class observation. However, the differences in type and intensity of the support can be observed: from live intervention to subtle encouragement.
Emotional Encouragement	36.3%	
Effect of supervisor's presence on student teachers		
Effect of supervisor's presence on student teachers	Percentage of respondents	Interpretation
Confidence Building	64%	A strong convergence in supervisor's presence and confidence building is revealed by the findings, with supervisor's presence acting as a positive psychological support, increasing a sense of confidence and certainty in teaching among the student teachers.
Initial Nervousness	24%	
Focused or detached	12%	

The results thus explains that supervisors were quite active and engaged during classroom observations, reinforcing their role as both evaluators as well as supporters of student teachers. Whereas a majority of student teachers benefited from supervisory support, a notable minority reported limited or no engagement, denoting inconsistencies in supervisory practice. Among those who did receive support, its nature and intensity varied, ranging from immediate interventions

during teaching to subtle encouragement and reassurance. Importantly, the results underscore the psychological value of supervisor presence, which was strongly linked with greater confidence and certainty in teaching among student teachers. Therefore, it is believed that beyond technical feedback, the symbolic and affective dimensions of supervision; like being present as well as supportive can play an essential role in tailoring student teachers' classroom experiences.

Table 3: Interaction between supervisors and student teachers after Classroom teaching session

Supervisory involvement during Class Observation		
Timing of the Feedback	Percentage of Respondents	Interpretation
Immediately after class	48%	The findings pointed out that the majority of student teachers received feedback immediately after their class observations or during weekly meetings with their supervisors.
Weekly review meetings	28%	
Periodic scheduled meetings	24%	
Modes of Feedback as received by the student teachers		
Modes of Feedback	Percentage of Respondents	Interpretation
Verbal	16%	A strong convergence of responses is revealed by the findings, showing that multi-modal feedback (both verbal and written) was generally preferred by supervisors for providing feedback.
Written	40%	
Both	44%	

Content of Feedback as received by the student teachers		
Content of Feedback	Percentage of Respondents	Interpretation
Constructive criticism	60%	The analysis revealed that while most of the feedback received by student teachers were constructive in nature, there was a balance of criticism and encouragement in it.
Actionable suggestions	24%	
Positive reinforcement	16%	
Focus Areas of the Feedback as received by the student teachers		
Focus Areas of Feedback	Percentage of Respondents	Interpretation
Classroom management	44%	The findings reveal that classroom management and instructional strategies were key concerns in the feedback as pointed out by the supervisors. Student engagement and clarity of content were also frequently emphasized.
Content delivery	28%	
Student engagement	36%	
Instructional techniques	32%	

The result underscores that timeliness as well as modality of feedback were primary attributes of supervisory practice. Majority of the student teachers stated about receiving feedback either immediately after classroom observations or during scheduled weekly meetings, assuring its relevance and applicability. The supervisors mostly employed a multi-modal approach, integrating both verbal and written feedback, that enhanced communication and supported better reflection by student teachers. The feedback was predominantly constructive, maintaining a balance between critical observations and encouragement, accordingly, fostering both professional improvement and confidence. The dominant areas addressed included classroom management, instructional strategies, student engagement, and content clarity, all of which are believed to be the core dimensions of effective teaching.

Objective 2: To assess how the student teachers implement the feedback into their teaching practices during the school internship.

The major views that emerged from the discussion with ten student teachers about

how they implemented the feedback into their teaching practices during the school internship are listed below:

Theme 1: Characteristics of the Most Useful Feedback

R1 stated: "When she pointed out specific areas like 'you need to give more wait time after asking a question,' I could directly apply it."

Another respondent, R7 mentioned: "Feedback on voice modulation and student questioning was very helpful."

Thus, the precise suggestions given by the supervisors were mostly valued by the student teachers, such as using more waiting time after questioning, improving blackboard usage, and voice modulation in delivering lessons (R1, R2, R3, R5, R7, R10). Such suggestions allowed them to apply the changes in classroom practice directly, creating a sense of direction as well as professional growth.

R8 stated: "Feedback on using student names and making eye contact helped."

Likewise, feedback pointing out interaction techniques, such as eye contact and student engagement (R4, R6, R8) were appreciated by some student teachers. This reveals that

student teachers valued feedback that helped in improving their classroom presence and student interaction, which are essential for promoting a positive learning environment.

R9 stated: "I found it helpful when they told me what went well before giving suggestions."

Fewer respondents also found it helpful when feedback highlighted their strengths before addressing weaknesses (R9). It is believed that these kinds of feedback not only promoted good practice among student teachers but also helped in building their confidence and their understanding of constructive criticism.

The above responses, therefore, underscore that feedback is most useful when it is clear, context-specific, and delivered in a supportive manner. Such feedbacks help student teachers understand what needs to be improved and how to be improved in a better way, eventually contributing to more reflective and effective teaching practices.

Theme 2: Efforts Made by student teachers in the Implementation of the Feedback

R7 mentioned: "I tried to apply the points in the very next class to check if it works."

Another respondent, R9 shared: "Yes, I implemented almost all the feedback given by my supervisor, and I felt proud and motivated when they noticed improvement." Majority of the participants thus made efforts to apply feedback promptly, even incorporating it into lesson planning (R1, R2, R4, R5, R7, R9).

R3 shared: "I did implement a few things, like using diagrams more frequently in my classes."

Likewise, some of the respondents implemented feedback partially; focusing on areas they found manageable and relevant (R3, R6, R8, and R10).

The above responses, therefore, suggests that the effective implementation of feedback depends entirely on the quality of the feedback provided by the supervisors as well as the motivation, planning and adaptability of the student teachers. It highlights the importance of equipping student teachers

with the confidence and autonomy to apply the feedback in a thoughtful way that fosters their continued growth.

Theme 3: Factors Influencing Student Teachers' Response to Implement the Feedback

R2 stated: "I implemented feedback that were short and direct, like 'using larger handwriting on the board' or 'checking if all students are following when I'm delivering a lesson.'"

Another respondent, R3 mentioned: "Feedback with specific tools or examples worked best for me. Like during a lesson, my supervisor said, 'use a chart here,' I could directly follow it."

Similarly, the feedback that were concise and clearly explained by the supervisors were easiest to be implemented by the student teachers (R1, R2, R3). Such forms of feedback involving actionable guidance helped them translate theory into practice in an efficient manner.

R5 shared: "I liked the feedback that was kindly delivered and explained with proper examples. I felt encouraged to improve my teaching."

Similarly, a kind, constructive and polite tone in providing feedback encouraged the student teachers to implement the feedback (R5, R7, R9).

R8 recalled: "Feedback with demonstrations; like my supervisor once showed me the techniques of questioning to increase student engagement, because he noticed that I mostly asked yes or no questions in my class. So, that was one of the easiest feedback to apply that has helped me in improving my classroom interaction skills."

As such, those supervisors who provided demonstration-based feedback including modelling or showing 'how to' implement the feedback were found to be more helpful by the student teachers (R8).

R4 described: "Feedback that matched what I myself felt about the class, those I implemented more easily."

Also, feedback that resonated with the student teacher's own perception of teaching was more likely to be applied by them (R4).

R10 highlighted: "I would've implemented feedback better if it was more detailed and related to my lesson plan."

Conversely, a respondent stated that the lack of detail, vagueness, and absence of subject-context feedback given by the supervisors hindered their motivation to implement the feedback (R10).

As the responses above show, the effectiveness of feedback is not only based on its content, but also on how it is communicated, contextualized and received by student

teachers. For feedback to be directed toward meaningful instructional change, it must be clear, kind, relevant, as well as, wherever possible, demonstrative.

Objective 3: To identify the challenges faced by the student teachers regarding the feedback they receive from supervisors during the school internship.

The figure and the table below highlight the valuable insights obtained from the student teachers (N=50) through questionnaires, regarding the varied challenges they faced while receiving feedback from their supervisors during school internship.

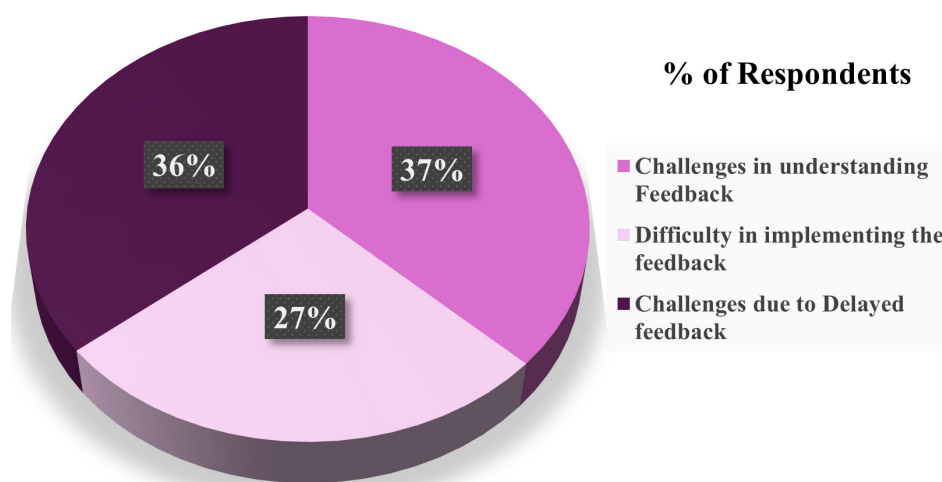


Fig 2: Percentage of student teachers with the challenges faced by them regarding the feedback they received from supervisors

Table 4: Challenges faced by the student teachers regarding the feedback they received from supervisors

Sl. No.	Challenges	% of Respondents
1.	Challenges in understanding the feedback	74%
2.	Difficulty in implementing the feedback	54%
3.	Challenges due to delayed feedback	71.7%

Interpretation: About 74% of the student teachers highlighted difficulties in understanding feedback. Under which, 30% noted the feedback language to be quite difficult, suggesting that using excessive

technical terminology have created confusion; 18% recalled contradictory feedback, which created uncertainty and lack of clarity regarding the supervisors expectations; 12% experienced feedback lacking concrete

examples and suggestions, indicating a need for more actionable guidance; 10% described the feedback not being specific to their teaching performance, which reduced its perceived relevance; and 4% felt the feedback being too vague, indicating that general comments without detailed explanation were not helpful. Additionally, 54% of the student teachers reported about facing significant challenges in implementing feedback: 22% noted time constraints as a major barrier, indicating that the demanding schedule of the internship limited their opportunities for implementing change in their teaching practices; 18% highlighted impractical feedback, suggesting that they concentrated on technical corrections rather than feasible classroom strategies; and 14% reported that the feedback was not specific enough to be implemented, reinforcing the need for more detailed and actionable input. Moreover, about one-third of the student teachers (71.7%) faced challenges due to delayed feedback,

involving 20.3% of the student teachers who could not make timely improvements due to delays; 17.1% experienced delayed feedback reducing its relevance and effectiveness, displaying a missed opportunity for real-time improvement; 15.6% forgot the specific lesson or context by the time feedback was given; 10.9% felt uncertain about their progress, indicating a psychological impact of not receiving timely guidance; and 7.8% reported continuing with the same mistakes, highlighting the practical consequences of untimely feedback. However, 28.3% reported no delayed feedback.

Objective 4: To provide suggestions for making feedback practices more effective during the school internship.

For providing suggestions to make feedback practices more effective during the school internship, ten student teachers were interviewed. The major suggestions that were put forward by them are listed in the figure and table below.

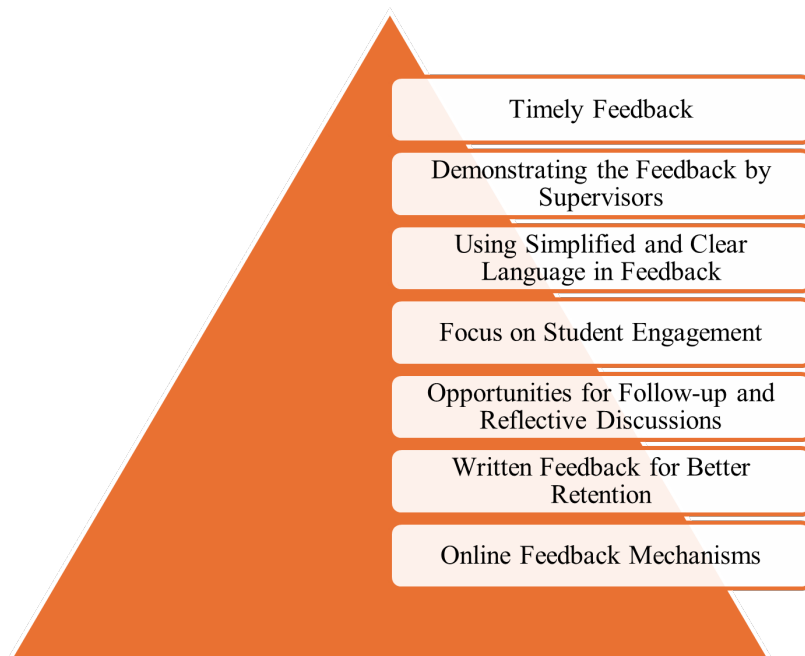


Fig 3: Effective Feedback Practices

Table 5: Suggestions put forwarded by student teachers to make feedback practices more effective during the school internship

Suggestions	Interview Transcript
Timely Feedback	“Feedback should be immediately provided after the class, be specific, and include examples on how to improve in the next class. This can definitely help in our growth as aspiring teachers.” (R3) “Feedback should be timely. Delays affected my motivation and clarity.” (R7)
Using Simplified and Clear Language in Feedback	“Feedback should be in simpler language and include concrete examples from my teaching.” (R1)
Demonstrating the suggestions by Supervisors	“It would be better if supervisors could model the suggestions once or give a demo, so that we could understand exactly what and how the mistakes could be improved.” (R5)
Opportunities for Follow-up and Reflective Discussions	“It was helpful. Still, I feel follow-up discussions with supervisor would make it more meaningful.” (R4) “To make the feedback process more effective, it could include timely follow-ups, and two-way discussions allowing me to ask questions and reflect deeply on the suggestions.” (R8)
Focus on Student Engagement	“The feedback was consistent; however, I think more emphasis on student engagement strategies would help.” (R9)
Written Feedback for Better Retention	“Clearer feedback and written comments would definitely help me retain the suggestions better.” (R6) “I used to forget most of the feedback provided by my supervisor, because she provided them verbally. I feel if they were in the written form, I could’ve kept a track of them and improved my teaching accordingly.” (R10)
Online Feedback Mechanism	“Online feedback mechanisms could somehow help to provide feedback timely and keep a track of communication with the supervisors.” (R2)

Interpretation: The findings illustrate that the most common suggestions were related to the timeliness of feedback. Also, a significant number of student teachers emphasized the need for follow-up interactions, demonstrations by supervisors, and clear communication of feedback. Similarly, a few student teachers highlighted the importance of written, reflective and technology-based feedback mechanisms. The analysis reveals that student teachers value feedback that is timely, actionable, and delivered through an interactive and supportive process. Improving these aspects will definitely lead to better motivation, and teaching outcomes among the student teachers.

Major Findings and Discussion

The descriptive and thematic analyses of the study were triangulated and discussed as below:

Descriptive analysis showed that 64% of student teachers had interaction before class; 62.5% of them reported increased confidence. Aspects included emotional support, planning, feedback, and expectations. Thematic analysis further indicated that student teachers appreciated pre-class communication as it gave clarity and boosted confidence. Lack of such interaction led to anxiety. When the findings were triangulated, both strands confirm the value of interaction before classroom

observation in boosting preparedness and emotional readiness. These findings are in line with the study by Cooper et al. (2010), who highlighted the importance of mentoring prior to observation of lessons in developing professional identity. In addition, White (2007) indicated that student teachers' confidence and clarity were enhanced through frequent pre-learning feedback. While interaction during classroom observation, 68.8% of supervisors used a collaborative style, enhancing student teachers' confidence and reflection. Student teachers valued feedback that was interactive and reflective, not one-sided. Collaborative communication is strongly preferred by student teachers and leads to greater trust and learning outcomes, which was highlighted in thematic analysis as well. According to Burns et al. (2016b) and Baeten & Simons (2016), collaborative supervision is significant in shaping effective teaching practices and professional identity of the student teachers. In support of these findings, Rodger et al. (2011) associated collaborative supervision in enhancing emotional outcomes. Moreover, 80% found supervisors very attentive during class; 66% received support. Among these, 63.7% got direct help, and 36.3% received emotional support. Thematic analysis also noted that student teachers found supervisor's presence helped in boosting their confidence but also caused initial nervousness. Emotional and practical support helped them manage classroom delivery better. The findings from both the analyses reveal that supervisor presence is psychologically and pedagogically significant for the student teachers during the observation. In line with these, Darling-Hammond (2010) & Hamalik (2005) underscored the value of in-situ support for emotional and instructional development. Omilani & Ogbonna (2023) also noted that supervisor engagement influences intern perceptions and effectiveness. Descriptive analysis of interaction after classroom observation, it was reported that 48% of the student teachers received feedback immediately, 28% during weekly reviews.

While asking about challenges, 71.7% reported about receiving delayed feedback. Thematic analysis, therefore, revealed timely feedback was most commonly suggested improvement, as student teachers stressed that immediate feedback was more useful, easier to implement. When the findings were triangulated, it was revealed that delays in feedback reduced its effectiveness. The results showed clear consensus on the importance of timely feedback to ensure its utility and reduce stress. These findings align with Sayeski et al. (2019); Hattie & Timperley (2007); White (2007) that emphasized timely feedback is critical for reflection and improvement. In support of these findings, Matsumoto-Royo et al. (2023) linked delayed feedback to emotional disconnection and reduced learning outcomes. Moreover, 40% of the student teachers reported about receiving both verbal and written feedback while 44% of the student teachers received only written feedback. Verbal-only feedback was rare (16%), pointing out written feedback was preferred for better retention and future references. Thematic analysis revealed that student teachers wanted a combination of multi-modal feedback (written + verbal), which is ideal both for clarity and reinforcement. In line with these, Adalberon (2021); Gibson (2006) advocated combining written and verbal feedback. Also, Morton & Kurtz (1980) stressed the complementary role of oral and written modes in instructive supervision. The feedback received mostly after classroom observation included constructive criticism (60%), with focus on classroom management (44%), engagement (36%), instructional technique (32%), and content delivery (28%). Additionally, student teachers valued actionable, specific, and example-based feedback, because they appreciated suggestions that focused on their behaviour and wanted practical, context-sensitive insights. Triangulated findings reveal that feedback should be constructive, actionable, and personalized, addressing real classroom challenges. Aligning with the findings, Hattie (2009); Smith (2010);

Akkuzu (2014) illustrated the relevance of specific, constructive, example-based feedback. While asked about challenges, 74% of student teachers reported difficulty in understanding feedback due to technical language (30%), vagueness (4%), lack of examples (12%), or conflicting messages (18%). Student teachers demanded simple and clearly stated feedback. Overly technical or vague inputs were hard for them to interpret and implement. When the findings were triangulated, it was revealed that clarity in feedback language is essential. Both datasets emphasize the need to simplify and specify feedback for better understanding and application. According to Abdelhalim & Alsahil (2025), clarity in the language of feedback in ELT is given great emphasis. Supporting the findings, Wisniewski et al. (2020) also focused on that clarity and form to determine the feedback's educational value for the professional development of student teachers. Moreover, 54% student teachers found it difficult to implement feedback due to impracticality (18%), lack of specificity (14%), and time constraints (22%). Thematic analysis reported that student teachers implemented feedback based on relevance, clarity, tone, and supervisor support. They stated that demonstrations helped them the most. Feedback aligning with their own perception was more likely to be used. Triangulated findings reveal that implementation of feedback is tied to clarity, feasibility, and relevance. Feedback must be realistic, specific, and accompanied by support or modelling to be effectively applied. Supporting the findings, Kushwaha (2014); Hattie & Clarke (2018) believed that the feedback that is implementable by the student teachers should be provided in such a way that they are tied to their visible teaching behaviours. Discussing about suggestions, student teachers highlighted the need for follow-up discussions, more regular supervision, and consistent involvement from supervisors throughout the internship. Student teachers want consistent mentoring, not one-time interaction, which can only be

achieved through follow-up meetings with supervisors that will ensure student teachers accountability and growth. According to Wainman (2011); Hunn (2009); Cooper et al. (2010) supervision must include ongoing, staged interactions between the supervisors and the student teachers. Aligning with these findings, Maes et al. (2022) stressed on providing formative feedback to the student teachers and organizing follow-ups as they are critical for long-term skill internalization.

Conclusion

School internships are not just practicums; they are a transitional space where student teachers begin to incorporate the identity, responsibilities, and nuances of being a professional educator. The present study, therefore, reaffirms that feedback is one of the crucial aspects for this transformation, when it is meaningful, timely, and dialogic. Beyond correcting instructional errors, feedback serves as an anchor for confidence, reflection, and pedagogical growth among the student teachers. Its impact lies not just in what is said by the supervisors, along with how, when and why it is said. The nature of the supervisory relationship, the tone of communication and the continuum of engagement – all these aspects shape how student teachers receive, interpret, and act on the feedback. Thus, effective supervision must move beyond evaluation to follow-up and mentorship, responsiveness, and trust. In recognizing the emotional and intellectual labour invested by the student teachers during internships, this study calls for a more humane and purposeful feedback culture, one that listens as much as suggests and supports as much as it evaluates. Only then can school internships fulfil their full purpose: not only to prepare teachers, but to empower them as well. These insights, therefore, have important implications for the policy frameworks guiding teacher education programmes, supervisor training, and school internships.

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Awareness of Reproductive Health among Adolescents in Schools under the CBSE Curriculum in Kolkata

Paramita Mukherjee*, Minara Yeasmin

Abstract

Understanding reproductive health is important to adolescents as it ensures a safe transition to adulthood. The study aims to understand adolescents' knowledge of their reproductive health, the impact of reproductive health issues on well-being of adolescents and suggest ways to promote school-based reproductive health education. Taking 185 adolescent boys and girls through simple random sampling from three PM SHRI Kendriya Vidyalayas of Kolkata under the CBSE Curriculum, the study employed two standardized questionnaires to ascertain adolescents' awareness of reproductive health and measure the impact of reproductive health issues on their well-being. The result finds that adolescents struggle to access trustworthy sources of information and lack adequate awareness of reproductive health. They are deprived of cooperation from parents, schools, and the media in understanding reproductive health. There remains a significant difference between boys and girls regarding their access to knowledge about reproductive health. Girls participate in menstrual awareness drives at school; they can talk to their mothers about it more frequently. Boys cannot talk to their mothers at home. They are excluded from reproductive health awareness drives at school. School education selectively prioritizes menstrual hygiene for girls. Irrespective of their gender, adolescents are ignorant about recognizing the impact of reproductive health issues in academic engagements. Students demand that knowledge about reproductive health be available to them in the school. School-based educational intervention in collaboration with the community appears to be effective, in which teachers are supposed to take up the responsibility to aware adolescents of the importance of reproductive health. This can equip adolescents with knowledge to make informed decisions, ensuring reproductive health well-being. .

Keywords: Adolescent Reproductive Health (ARH), Adolescence, Awareness, Access to information, HIV/AIDS, Reproductive health education.

Introduction

The adolescent population includes the age group of 10 to 19 years; this phase is important as puberty is attained, and it is marked by the initiation of sexual activity. Biological changes along with psychological changes and resultant impulse and recklessness make adolescents vulnerable to reproductive health risks (Majer et al., 1992). Lack of adequate knowledge and skill may cause unwanted pregnancy, unsafe abortion, sexually transmitted infection, maternal

mortality, infant mortality, and long-term morbidity. The reproductive hormone surge and mental cum physical response to that cause health challenges which intensify with the lack of toilet infrastructure both at school and home. Such challenges might prevent them from spontaneous participation in school activities. They feel embarrassed to communicate their needs to the social sphere as reproductive health is stigmatized in most underdeveloped countries like India (Ahmed et al., 2020). Adolescents suffer from reproductive health issues in silence. They

lack accurate knowledge. Many adolescent girls suffer from polycystic ovary syndrome caused by their unhealthy lifestyle. The causes, effects, and measures are hardly known to most of them, but it has a serious and long-lasting effect on their reproductive health in the future. Cultural factors create an inhibitive environment for discussion about reproductive health, and gender norms create barriers to accessing reproductive health information and services. Negative social consequences may lead to school dropouts, reducing their future employability with long-term economic implications (Alemu et al., 2017). Adolescents are curious about the process of transition to adulthood. Their concerns about reproductive health are addressed with myths and half-truths. This dissuades them from asking questions. They struggle to access trustworthy sources of information. The pessimistic feedback of elders turns them to their friends seeking answers. These sources are generally unreliable as they themselves are confused. Thus, it provokes misconceptions about the issue. Parents do not advise honestly as is expected by teenagers. School-based learning does not always equip the youth to understand reproduction, contraception, consenting adults, and the emotional aspects of relationships. The teachers lack effective training to enhance the skills of their students. So, like their parents, their schools too fail to rise to the occasion. Available information on social media is abundant, but not all is reliable. They fail to discriminate between false and authentic information (Gise et al., 2012). Though a few movies and online platforms deal with reproductive health issues but still imparting knowledge through reliable sources remains crucial.

HIV/AIDS is a fast-spreading sexually transmitted disease where the overall immunity of the human body is compromised. The worldwide spread of HIV/AIDS is attributed to unsafe sex and the absence of concrete information about how it spreads (Catalano et al., 2010). Our societal norms do not allow open and free discussions, so adolescents lack awareness of vital medical

facts of reproductive health and HIV/AIDS. There is a need of communication of effective knowledge of reproductive health through multiple channels so that adolescents can be made aware of their reproductive health issues (Bearinger et al., 2007).

Sustainable Development Goal 5 calls for the realization of human rights and gender equality. Along the same line, UNESCO has always been in favour of the recognition of sexuality as a natural part of human development (Schalet et al., 2014). It advocates for a structured learning environment in schools for comprehensive sexual education (UNESCO, 2018). The existing literature recommends the delivery of curriculum-based, age-appropriate, and culturally responsive content through multisectoral collaboration (Engel et al., 2019). Knowledge of reproductive health management firmly supports adolescent boys and girls in their successful journey to adulthood. By and large, it is considered a human right of adolescents to receive age-appropriate, culturally responsive reproductive health education (WHO, 2018). It empowers adolescents to make informed decisions (UNESCO, 2018). The Government of India in collaboration with UNFPA has drawn up a national action plan for the introduction of adolescent reproductive and sexual health education to facilitate adolescent understanding of changes, develop awareness, help them manage problems with social skills, and ultimately help them avoid vulnerability (Sahin et al., 2018).

Data from National Family Health Survey (NFHS) 2019-20 shows that 42% of girls get married before the age of 18 years, 16% of adolescent girls get pregnant and give birth before the age of 18 years and HIV infection is prevalent among the adolescents of 15-19 years age groups in the state of West Bengal. Kolkata does not deviate much from the state statistics, with the dropout rate of adolescent girls, especially in Classes IX-XII, being alarming. Our National Education Policy 2020 also recognizes the long-pending need for reproductive health education. It has proposed the initiation of teaching-learning

on the well-being of reproductive health. The CBSE schools have already been teaching different socio-cultural aspects of adolescent reproductive health. CBSE has published the Teachers' Workbook for Student Activities under the Adolescent Education Programme, which is a reference material for teachers and heads of schools. Unfortunately, CBSE schools in Kolkata do not implement these actions in the true spirit. The percentage of adolescents experiencing their first pregnancy is increasing in the city. The literature review unfolds that adolescent reproductive health extends beyond the medical context to social, psychological, and public health perspectives. Adolescents need practical guidance in an enabling environment (Chadra-Mouli et al., 2015). There is a need to explore the efficacy of school-based reproductive health education to promote the well-being of adolescent reproductive health. The present study is an attempt to assess knowledge and awareness and measure the impact of adolescents' reproductive health on their well-being, and argue in favour of school-based reproductive health education.

Rationale

Reproductive health-related physiological processes cause physical discomfort as well as psychological stress among adolescents. Attainment of puberty and subsequent adjustments sometimes take a toll on their academic performance. A lot of social stigma is shrouded around puberty. Poor knowledge and lack of scientific information complicate the situation further (Kotecha et al., 2009, 2012). Lack of adequate skills makes adolescents suffer from reproductive health challenges (Hall et al., 2018). A menstrual health survey by 'Anahat, an NGO', in 10 schools in Kolkata shows 37.6% of girls missed school and 15.3% preferred not to attend school during their periods. 17.6% of girls chose to skip due to unsatisfactory toilet facilities. NHFS 2019-20 found that most of the adolescent girls were using hygienic menstrual methods, but their misconceptions about their period were still present. Most of them were not prepared

for menarche as they did not know about menstruation before reaching menarche (IIPS and ICF, 2021). The conditions of boys are further depressing. Fathers never feel the need to talk about puberty or masturbation. With growing age, they become uneasy about sharing experiences with mothers, female members of the family, even with teachers and friends from the opposite gender. Most of the research on adolescent reproductive health has focused on assessing adolescent reproductive health problems and the availability of health services. A few researchers have tried to focus on how adolescents' academic involvements are affected by their reproductive health. Thus, academic management of reproductive health received little attention. Formal and non-formal ways of educating adolescents about the well-being of their reproductive health and curricular interventions in generating awareness have lacked the attention of researchers so far (Rafique & Al-Sheikh, 2018). There remains a wide research gap regarding gender-wise differences in adolescent reproductive health awareness, the impact of reproductive health on adolescent well-being, and management of adolescent reproductive health through school-based adolescent reproductive health education.

Objectives

- To analyse the level and source of awareness regarding reproductive health among Class XI students in CBSE schools in Kolkata.
- To evaluate the impact of reproductive health on the well-being of adolescents.
- To propose evidence-based recommendations to promote adolescent reproductive health through school-based education.

Research Questions

- Do adolescents' actual sources of knowledge about their reproductive health differ from their preferred sources of knowledge?
- How well aware are adolescents of their reproductive health?

- How does the reproductive health of adolescents affect their well-being?
- Do awareness and impact of adolescent reproductive health differ according to gender?

Sample and Sampling

The sample consisted of 185 adolescent boys and girls of Class XI from the three PM SHRI Kendriya Vidyalayas in Kolkata city. Simple random sampling was used to choose the schools. Location-wise data offers wide spatial diversity. For data collection, students from the arts, commerce, and science streams of Class XI were selected through random sampling.

Then, from the selected sample, students who were found to be expressive and had greater involvement and interest in participating in

the study were selected for the focus group discussion.

Students of Class XI were chosen because Class XII students were unavailable on account of their ongoing board examinations. Class XI students (range of age 14-18 years) were expected to be able to express their thoughts clearly and explain the reason behind such experiences. Adolescents below 14 years of age would find it difficult to develop strong opinions about such a topic, which is shrouded in mystery. In their early adolescence, they struggle with the suddenness of transition and just begin to develop their understanding of reproductive health. In Class XI, the range of age of surveyed students was found to be 14 to 18 years.

Table 1 shows the list of selected schools along with the Class XI students (adolescent boys and girls) who participated in the study.

Table 1

The age group of the selected sample from Class XI was 14-18 years							
Name of the schools	No. of boys			No. of girls			Total
	Humanities	Commerce	Science	Humanities	Commerce	Science	
PM SHRI Kendriya Vidyalaya Ballygunge.	10	18	20	12	14	15	89
PM SHRI Kendriya Vidyalaya Command Hospital.	10	14	11	10	7	9	61
PM SHRI Kendriya Vidyalaya Fort William.	10	5	6	9	4	1	35
Total	104			81			185

Methods and Tools

An explanatory sequential mixed-methods research design was adopted, where quantitative and qualitative approaches were combined. With the questionnaire survey, data were collected from the chosen sample and were analysed with statistical methods. Later, with focus group discussion, qualitative data were collected and thematically analysed. Quantitative and qualitative findings were discussed together for a comprehensive understanding.

Quantitative results were substantiated with insights gained from subsequent focus group discussions.

Two questionnaires were used as tools.

- (a) Illustrative questionnaire for interview-surveys for young people about sexual and reproductive behaviours prepared by J. Cleland et al. and published by WHO(2001) is re-standardized by researchers in 2023(validated by subject experts and found reliable through the Cronbach-alpha test with $r=0.80$). From the

original tool, questions related to knowledge about reproductive health gained from parents, family and friends, media, school environment, and health facilities, knowledge of the age of marriage, parenthood, HIV/AIDS awareness, and managing reproductive health were considered for the study.

The tool contained 31 closed-ended questions. A few sample questions are given below:

- How does HIV spread?
 1. If anyone comes in physical contact with the affected ones (touch/ cough / sneezing/ exchange of blood)
 2. If anyone comes in sexual contact with the affected ones only
 3. Due to natural causes (weather issues/ habitat-specific causes)

Manual for measuring the impact of reproductive health on well-being of adolescents was prepared and standardized by the researchers in 2023. The standardization process involved a pilot study where the above-mentioned questionnaire was tried out on 85 randomly chosen adolescent boys and girls. The validity of the tool was checked by two subject experts, and their suggestions were incorporated before the trial. The reliability value by Cronbach's alpha was =0.75. This tool asks questions about the impact of adolescents' reproductive health on adolescents' well-being (psychological, curricular and co-curricular, social, and physical). The tool contains 25 items; five possible modes of choice are provided against each, such as: Strongly agree, Agree, Neutral, Disagree, and Strongly disagree. Some sample items are given below:

1. I feel mentally bothered by my bodily changes in adolescence.
2. I feel stressed because of the lack of infrastructure in school (a toilet for change/to refresh) to manage reproductive health needs.
3. I have missed school due to the issues related to my reproductive health (the bodily changes I am encountering).
4. I miss my playtime and play sessions when I pay attention to my reproductive health needs.

5. I feel embarrassed to talk about my recent bodily changes to members of my family.
6. I do not feel awkward talking about my recent bodily changes with my teacher.
7. I do not feel physically stressed as a result of recent bodily changes related to the transition process to adulthood.
8. Due to mismanagement of reproductive health, I have faced serious health problems.

Focus Group Discussion (FGD)

With focus group discussion, explanatory qualitative data were collected from a few selected students out of the total sample of the study.

- i. As boys and girls shared experiences of sources of information and their preferences for sources of information on puberty, reproductive system, and relationships, the recurring trend of their responses was identified, and each important segment was labeled with descriptive words, i.e., codes. Patterns generated from the codes helped in summarizing the findings. These patterns were analysed as themes, and the comparison of the themes described how adolescents are deprived of reproductive health knowledge from their preferred source of information. (Table 3)
- ii. To understand how adolescents want assistance from parents, school, and media in managing their reproductive health, the respondents were asked the following questions:
 1. How do you want your parents to respond to you?
 2. What kind of assistance do you expect from your school?
 3. What role should be played by the media?

Their responses were analysed. Similarities were observed and categorized into important segments with descriptive words (by the researcher after consultation with an expert). Then themes were generated from the recurring pattern and relationship between codes. It enabled

the analysis of adolescents' expectations on how they would like to be assisted by parents, schools, and media in their understanding of reproductive health in relation to what they received from them. (Table 4)

Findings and Analysis

Table 2 shows an analysis of the knowledge and impact of adolescent reproductive health among students of the Central Board of Secondary Education

Table 2: Analysis of the knowledge and impact of adolescent reproductive health among students

Variable	Subcategory	Gender	N	Mean	SD	Df	t-value	Remarks
Adolescents' Reproductive Health Knowledge	Parental guidance	Boys	104	3.51	0.86	183	2.572	0.011 S*
		Girls	81	3.90	1.21			
	Role of school	Boys	104	4.92	0.95		5.428	0.000 S**
		Girls	81	5.71	1.03			
	Medical knowledge	Boys	104	6.45	1.71		0.270	0.787 NS
		Girls	81	6.38	1.75			
	Knowledge of HIV	Boys	104	15.51	2.28		0.6755	0.513 NS
		Girls	81	15.72	1.91			
Well-being of Adolescents	Psychology	Boys	104	23.54	4.96	183	2.189	0.030 S*
		Girls	81	21.90	5.15			
	Curricular and co-curricular	Boys	104	19.13	3.02		2.650	0.009 S**
		Girls	81	17.84	3.57			
	Social	Boys	104	18.60	3.66		0.580	0.562 NS
		Girls	81	18.96	4.94			
	Physical	Boys	104	23.18	3.71		1.476	0.142 NS
		Girls	81	23.98	3.50			

S*= Significant at 0.05 level, S**= Significant at 0.01 level and NS= Not Significant at 0.05 level

There remains a significant difference between adolescent boys and girls:

(a) Boys do not talk to their mothers:

The above table indicates that girls receive more support from their parents. They have access to information related to reproductive health through parents, especially their mothers, as primary sources of knowledge. The findings of the study clearly show that it is still embarrassing to hold discussions on reproductive health issues. Adolescents primarily had conversations with their mothers, who responded to their concerns about physical health and well-being. These conversations are influenced by gender roles.

Boys cannot talk to their parents about reproductive health. Boys usually are afraid to approach their mothers in such social construct and only talk when they face reproductive health problems like genital infections, acne, sweating, etc. Mothers nurse them, comfort them but cannot explain to them the causes of development of reproductive organs and troublesome changes, ways to prevent and adjustments, i.e., practical solution to the problems. The depth of rare conversations remains shallow as sons are younger, opposite in gender. Unlike girls, boys do not know exactly when they reach puberty. They are deprived of practical knowledge or support to cope with the changes.

A silence is deliberately maintained over

reproductive health matters. This is not accidental but rooted in cultural taboos. Moreover, parents of adolescents do not know how they should talk to their children. Stereotypical social frames, gender norms prevent boys from sharing their reproductive health secrets with their mothers. Fathers are not asked out of embarrassment to answer reproductive health queries. The male members of the family deliberately remain mute about this. They leave this to the female guardian on account of social conventions. Neglecting such discussions is one of the age-old practices without any change. One of the respondents from Kendriya Vidyalaya Ballygunge said, "When I asked mom about nocturnal emission, she replied that only bad boys talk about these and forbade me to raise such topics before father and her." Sometimes parents hide facts when adolescents ask them, provide misinformation, and try to escape from the situation. One girl told, "Mother told me to stay away from the kitchen and prayer room during periods as we become dirty at that time." Both boys and girls in the study were rarely found to visit any health clinic or have listened to any doctor speaking on scientific aspects of reproductive health. Their awareness level should have been much greater, but they seem to have neglected this matter, being discouraged by family and school (Crocker et al., 2019). This negligence is the outcome of the absence of open and informative discussions across genders. Thus, the concept of reproductive health is gendered. Adolescents were not found to be aware of the general facts of HIV/AIDS. One of the girls from Kendriya Vidyalaya Fort William said, "I don't know whether men can catch HIV or whether treatment is available for this disease". Thus, reproductive health issues remain mysterious, and adolescents lack awareness about them.

(b) Schools do not provide effective education: Girls are found to have attended various menstrual health awareness programmes frequently organised by schools in collaboration with NGOs. Such awareness programmes are rarely designed for

male students. Boys have generally not been part of any informative sessions (Thirunavukarasu et al., 2013). Schools are mainly focused on developing healthy menstrual practices among girls; to them, this is all about reproductive health knowledge. It means they fail to understand various aspects of girls' reproductive health other than menstruation, and aspects of the reproductive health of boys together make up adolescent reproductive health. Again, an important finding of this study is that the understanding of reproductive health at school is over-generalized and gendered. Boys do not get periods and the resultant physical strain. It makes us think that boys are beyond transitional suffering. Such incomplete understanding does not encourage adolescents to share their minds; rather, they ignore their feelings and stop them from coming forward with what they go through. As there is no discussion about such issues, the communication gap forces us to overlook the unspoken problems of boys, especially their psychological changes during adolescence. Adolescent boys should know about the maturity of reproductive health, the ways of birth control, the age of parenthood, and be part of awareness campaigns, so that they understand this phase of life, the human reproduction system in totality, prepare for future roles, and be respectful to their opposite gender.

The menstrual awareness drives in schools do not impart in-depth knowledge of reproductive health. So, instead of being part of them, girls hardly develop knowledge about vital medical facts of reproductive health. Both boys and girls of CBSE schools are not found to have sound knowledge about puberty, reproductive organs, relationships, and HIV/AIDS. Schools cannot effectively address these problems because of the absence of a structured curriculum and effective policy.

Impact of adolescent reproductive health on the well-being of adolescents:

- (c) Girls suffer from mental pressure: It is clear from Table 2 that there remains a significant difference between boys and girls regarding the impact of reproductive health on their well-being. Girls encounter mood swings and feel depressed and suffer from mental stress more than boys (Ekpenyong et al., 2011). One of the girls in Kendriya Vidyalaya Ballygunge expressed, "I prefer to stay away from school as I frequently catch a urinary infection by using the school toilet during my periods." Their spontaneous participation in curricular activities is disturbed in the turbulent transition of adolescence which, they blame, act towards lowering their performance level (Rawat et al., 2015). One of the girls said, "My performance in the exam could have been better if I had

not suffered from weeklong period of pain." According to another girl, "I had withdrawn participation from sports due to the onset of my period".

Irrespective of their gender, adolescent students were found to have undergone restlessness as they could not ventilate their feelings in the social sphere. Parents, family members, teachers, and friends avoided discussions due to the stigma attached to the topic and failed to provide social support. An adolescent student said, "I feel embarrassed to talk about my bodily changes with family members." They did not find a respectful environment to discuss adolescent reproductive development. So, they did not have the awareness to be able to relate the cause-and-effect relationship of reproductive health and physical discomfort. They need preparation in the preadolescent phase to develop self-resilience.

Table 3 shows a comparison of actual and preferred sources of information about ARH.

Table 3

Topics related to Adolescent Reproductive Health	Actual source of information		Preferred source of information	
	Boys	Girls	Boys	Girls
Puberty	Friends, doodle art on the wall of the school toilet	Siblings and mother.	Parents, teachers, doctor	Mother, teachers, doctor, and elderly family members
Reproductive system	Social media, internet searches. (TV advertisement of sanitary napkin, contraceptives).	Social media, magazines, and books.	Teachers and medical practitioners.	Teachers, medical practitioners
Relationship	Friends, films (OMG2, Padman), and videos	Friends, movies, and newspapers.	Teachers, parents.	Teachers, parents.

How actual and preferred sources of knowledge are different: Students seek reproductive health knowledge from parents, as one of the students commented, "I would like my mom to talk to me about puberty without hide and seek." Social taboo restricts discussion on puberty-related physical transformation between parents and their children. This makes adolescents turn to their friends. Friends are their actual source

of information about reproductive health. They do not always feel comfortable seeking information from peers. They are not always convinced by what their peers say because they suspect that those casual answers lack quality, are sometimes inaccurate, and are full of missing links. It seems friends are not considered as a trustworthy source of information, as one of them said, "Not everything can be shared with a friend, as they

may make fun of my secrets.” Adolescents are exposed to books, magazines, and media where they come across information on reproductive health. Adolescents expressed such situations when they failed to discriminate misconceptions from authentic information: “I often get confused as facts stated in one source are so contradictory to others.” Almost all the respondents clearly said this type of information is best to come from teachers because that would ensure authenticity. Future policy makers must think of the role of teachers in educating adolescents about reproductive health.

Social media serves young minds with

half-truths and superficial information; respondents of the study admitted to having misinterpreted information at times. The surveyed adolescents, irrespective of their gender, confirmed that they hardly know or use information from social media. Available information is not age-specific, so it lacks relevance, and the agenda-driven advertisements do not guarantee accurate information. They prefer to be taught by teachers with quality information regarding safe practices to discard misinformation.

Table 4 shows how parents, schools, and social media can form knowledge, attitudes, and skills among adolescents.

Table 4 What adolescents want from parents, teachers, and media as their guides				
THEMES		KNOWLEDGE	ATTITUDE	SKILL
CODES		Easy conversation Vs silence	Honest answers Vs moral judgment	Enabling environment Vs discouraging environment
Parents		“I will be happy if my parents clarify my doubts, without scolding.”	“I do not like mom stopping me from asking about puberty, saying these are bad topics.”	“I wait for my mother to initiate talks about puberty.”
		“I would like my mother to share her transitional journey with me.”	“I am afraid of embarrassment both parents have, so I do not initiate a talk on my physical development.”	“I feel bad as mother says I am touched by a crow when I have my periods.”
Teachers		Misinformation Vs Authentic knowledge	“I have seen my mother scolding my sister to be talking about puberty to me.”	“It is okay to be friends with the opposite gender, and parents should not be skeptical about that.”
		“I doubted mother was wrong in saying period is discharge of dirty blood.”	Abet discrimination Vs gender equality	Irresponsibility Vs Problem solving
Media		“Why can I not have sour fruits during period?”	“I would like to be taught lessons on respectful boundaries in relationships and practical approaches about reproductive health of both boys and girls instead of selective education.”	“I feel the need for practical lessons on management for making decisions about my reproductive health.”
		Teaching-learning of scientific information VS prejudice		“Lessons should encourage thinking critically about the
		“I really want to learn about the human reproductive system from school teachers that would be authentic.”	Confusion Vs defying taboo	Social stigma Vs community awareness
		Practical guidance Vs taboo	“A Durga puja themed as <i>Ritumati</i> put spotlight on menstrual hygiene to break taboo and mystery around puberty.”	“Community cycling event on World Aids Day sensitized the entire society on the well-being of reproductive health.”
		“Would like to watch a TV show on reproductive health awareness, as I did on covid-awareness.”		

Parents, schools, and media can contribute to the development of knowledge, attitude, and skill among adolescents about their reproductive health. The analysis of the focus group discussion clarifies the need for doubt-clearing communication between parents and adolescents. Parents need to encourage their wards to approach them in need, answer their queries, and earn their trust. Well-structured curriculum should be there to guide adolescents about reproductive health challenges and their effective management (CREA, 2005). The schools need to implement reproductive health education in true spirit with equal concern for adolescent boys and girls. Addressing such a situation as "I am afraid to talk to girls in my class as they are so different from boys," is important as adolescents should learn to support each other and face the challenges of this age with respect for the opposite gender (Utami et al. 2024 and Alekhya et al. 2023). To address the comments like this, "I like a boy in my society but can't tell it to anyone as they may think I am bad in character," students need to be accurately counselled by the teachers to understand the causes and consequences of actions, and based on that, make decisions to express themselves. The teachers are endowed with the responsibility to implement the plan of action in this regard. The objective of school-based Adolescent Reproductive Health Education (ARHE) is not only to build knowledge but also to facilitate practical solutions. Engaging the community is indispensable. In this regard media must strive for mass awareness of prejudices and create social support to prepare adolescents for solving problems skillfully and arriving at decisions by navigating through options (Majer et al. 1992).

Discussion

Adolescents are ignorant and fail to recognize the importance of sound reproductive health. Management of reproductive health is linked with the realization of millennium development goals like achieving universal education, promoting gender equality, women

empowerment, improving maternal health, reducing child mortality, combating HIV/AIDS, and eradicating poverty (Cherenack et al., 2021). Education is considered a major tool for promoting sustainable reproductive health and well-being.

The culture of silence on adolescent reproductive health: Adolescent Education Programme (AEP-2013) could not be implemented in the true spirit because it did not receive spontaneous acceptance among teachers and parents. As revealed in the survey, teachers exclaimed, "talking about sexuality would increase sexual activity among adolescents, and students should talk about it once they are adults." Such responses prove that teachers consider reproductive health to be a matter of shame. At the same time, they are also clueless about how to guide adolescents about reproductive health. Teachers avoid such discussions as the formal curriculum does not impose them strictly. Both teachers and parents suppress insightful communication and the expression of thoughts about reproductive health. This stereotypical mentality does not acknowledge the importance of communication on reproductive health, as it seems to be awkward.

That calls for a renewal of efforts in promoting adolescent reproductive health through school-based adolescent reproductive health education.

i. Implementation of policies: School-based, age-appropriate, and culturally responsive interventions under a structured curriculum can empower a large number of adolescents at one time with scientific knowledge. Central and state boards of education may collaborate to frame one such uniform curriculum with overlapping knowledge from different subjects for early intervention in the light of NEP 2020. Implementation of AEP (NCERT, 2013) in its true spirit has a great scope of educating adolescents about reproductive health.

ii. Empowerment of school teachers: Teachers must be empathetic towards the transitional phase of students. Teachers

may be adequately trained to become a trusted source of knowledge for adolescents. The exchange of ideas in recognized platforms with experts and other teachers from across the country can develop their expertise in counselling for challenges like absenteeism, poor concentration, and physical discomfort as a result of reproductive health. A student opined with conviction, "We want to know it all from teachers, we trust them the most."

iii. Inspire the community for social support: Schools need to engage the local communities through workshops, seminars to draw their attention. Active participation of all stakeholders in removing stigma around reproductive health will create an enabling environment. The government may collaborate with NGOs and even local clubs in organizing rallies, campaigns, and observation of special days to sensitize adolescents and their sphere of interaction to develop social support.

iv. Improved access to reproductive health services: Mass media need to play an important role in dissemination of information to improve access to reproductive health knowledge and services. Newspaper reporting, movies, short films, and several art forms can update adolescents on information about reproductive health and services. Based on that, informed decision can be made.

Implications of the findings for research questions: The present work found that adolescents are not aware of their reproductive health and its effects on their well-being. Concerns of reproductive health are shrouded in mystery. Adolescents' understanding of their reproductive health is incomplete and gendered. School-based education is selective, partial, and gendered, leaving adolescents clueless about their transition. Structured curriculum is needed to develop holistic awareness, the right

attitude, and informed decision-making skills to help adolescents navigate through the challenges of reproductive health. The situation demands the successful implementation of adolescent reproductive health education (Odo et al, 2018).

Conclusion

The study concludes that adolescents under CBSE schools in Kolkata are yet to develop requisite knowledge about their reproductive health and its impact on their wellbeing. The understanding of reproductive health is gendered. So, adolescent boys and girls receive disproportionate attention from parents and schools. There is silence about the issues, and their sufferings go unnoticed. Adolescents have the right to know the causes, consequences, and management of their transition to adulthood. At the community level, too, there should be awareness so that reproductive health issues are not treated as a stigma. Their parents, schools, teachers, and mass media are all stakeholders in making the adolescents aware of safe practices and informed decision-making. Adolescents should be mobilized to avail services in need instead of suffering unattended. Reviewed and modified initiatives must be taken to accelerate the implementation of comprehensive reproductive health education towards adolescent reproductive health well-being.

The Ministry of Education, Government of India has paid attention to it, proposed changes, made provisions in the newly framed curriculum (NEP-2020) and has introduced the topic in the syllabus (in subjects like Biology, Geography, and Environmental Sciences at different standards) towards the long-awaited realization of Sustainable Development Goal 4. All these initiatives can serve no good if implementation is not strict. Now is the time to work towards stronger institution-led quality education in the direction of a peaceful and just society.

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Factors Affecting Student Absenteeism in Rural Elementary Schools of Kalahandi District of Odisha

Deeptimayee Sagar*, Prasanta Kumar Nahak

Abstract

This study attempts to understand student absenteeism by exploring its related factors in rural elementary schools of migration-prone Golumunda block in Kalahandi district. The study also aims to assess the measures taken by the stakeholders to address this issue. A mixed-method approach with an explanatory-sequential design was followed. The students, parents, teachers, and headmasters of elementary schools constituted the population of the study. Cluster and purposive sampling techniques were followed for the quantitative and qualitative phase of data collection respectively. Student enrolment and retention data sheets, structured and semi-structured interview schedules were used as the tools for data collection. The quantitative data were analyzed through frequency and percentage analysis, while the qualitative data were sorted, coded, categorised and analyzed thematically. After analyzing the data, four overarching themes were generated. They were weak economic condition of families, lack of aspiration towards education and career among students, casual attitude of parents towards children's education, and inadequate community participation. By incorporating the perspectives of various stakeholders, attempts were made to comprehend the nuances of absenteeism that can help parents, educators, educational administrators, and policymakers to gain a deeper understanding of the nature of absenteeism. Proper planning and interventions would result in better school attendance, retention, adjustment, and high educational achievements of students.

Keywords: Elementary Education, Primary Education, Sarva Shiksha Abhiyan (SSA), School Education, Student Absenteeism, Student Retention, School Dropout, Universalization of Elementary Education (UEE)

Introduction

Education, the most vital asset to human beings, not only empowers individuals but also strengthens society. Education in its general sense is a form of learning in which the knowledge, skills, and habits are transferred through teaching, training, or research. Any experience that has a formative effect on how one thinks, feels, or acts may be considered educational (Tyagi, 2021). Elementary education is the first step towards the entire educational journey. The education that children receive at this stage lays down the foundation for their

physical, intellectual, social, emotional, and moral development. Realizing its value, the Sustainable Development Goal 4 (SDG 4) of the United Nations (UN) aims to ensure that all the girls and boys complete free, equitable, and quality primary and secondary education leading to relevant and effective learning outcomes by 2030.

Across the world, 155 countries provide elementary education on a compulsory basis (UNESCO, 2020). In India, by the 86th amendment of the Indian Constitution in 2002, a new Article, i.e., Article-21(A) was introduced that brought elementary education under the purview of the

Fundamental Rights. It guarantees free and compulsory education to all the children in the age group between 6 and 14 years. Despite that, the goals of Universalization of Elementary Education (UEE), i.e., universal access, enrolment, retention, quality education, equity, and achievement are yet far from realization (Govinda and Mathew, 2018). In most of the rural and backward areas of India, education at the elementary level witnesses the problems of large-scale absenteeism and dropout. The highest priority in education should be to ensure that not only all children start schooling but also remain there long enough regularly to acquire literacy, numeracy, and basic attitudes and skills which will help them to improve the quality of their life (Bisht, 2015).

Absenteeism is a common problem in most of the rural elementary schools and is essential to deal with. Presently, absenteeism is widespread but usually remains unacknowledged, especially in rural and underdeveloped areas. As per the UNICEF global database, in developing nations across the globe, nearly 90 per cent of children attended primary school in 2021, of which eight per cent were unable to complete their schooling (UNICEF, 2021). The Annual Status of Education Report (ASER) identified student absenteeism rate at 28 per cent across all states in rural India (ASER, 2019).

Several causes behind student absenteeism have been revealed by a number of studies. These studies, exploring both Indian and foreign contexts, have identified various factors related to absenteeism including geographical location of schools, classroom atmosphere, personal attitude of students, economic set-up of families, teacher, and home-related factors (Daka, et al., 2021; Ghosh, 2021; Mafa, 2018). Bullying, excessive use of internet and gaming, reduced family involvement, suicide attempts, and existential hopelessness were also reported as crucial factors behind student absenteeism (Haque,

et al., 2024). Furthermore, educational and community factors, such as lack of connection between classroom teaching and real-life situations, lack of communication between parents and schools were also identified as contributing factors towards student absenteeism (Assefa, 2018; Cook & Ezenne, 2010). Absenteeism in school adversely impacted the teaching-learning process resulting in poor performance, inability to comprehend concepts, improper socio-emotional development of students, and fostered indiscipline (Akkus & Cinkir, 2022; Santibanez & Guarino, 2021; Kabanga & Mulauzi, 2020).

Absenteeism is a tendency, which is psycho-social in nature. The cause of such behaviour may relate to school, home, or personal areas. Although researchers have investigated the problem before, further exploration is required to identify the crucial factors, particularly in rural settings of underdeveloped districts like Kalahandi where absenteeism is witnessed at large scale. This study explores the enrolment and retention status as well as the factors behind student absenteeism in rural elementary schools of Golamunda block of Kalahandi district through a mixed-method approach. The findings can be helpful for parents, educators, educational administrators, and policymakers to gain a deeper understanding of the nature of absenteeism and to plan future modalities accordingly. Proper interventions would result in better school attendance, retention, adjustment, and high educational achievements of students.

Concept of Student Absenteeism

Absenteeism means the absence of a student from class when she/he is scheduled to be present. Student absenteeism can be conceptualized as the temporary cessation of students when their presence is expected or absence of students from class during the regular working hours of the school.

Methodology

Design

A mixed-methods approach with an explanatory-sequential design: participant selection model (Creswell & Clark, 2007) was followed in this study. It was a two-phase mixed methods design that started with the collection and analysis of quantitative data. Based on the result of the first phase, the subsequent collection and analysis of qualitative data was carried out.

Sample and Sampling Techniques

The various stakeholders who participated in this study were the students, parents, teachers, and headmasters of elementary schools of Golamunda block. Seven Gram Panchayats from Golamunda block – Golamunda, Khaliakani, Manjhari, Chapria, Brundabahal, Kegaon, and Chichia – were selected for data collection. These panchayats were selected because large scale absenteeism had been reported from these areas. As most of the inhabitants from these panchayats are marginal farmers and daily-wage labourers, they adopt seasonal migration as a major livelihood strategy. They usually prefer not to leave their school-going children behind in the village as the duration of migration is too long, spanning around six to eight months. Most of the children migrate along with their parents, which results into large scale absenteeism in schools of these areas.

Data Collection

A total of 1772 absentees were identified from 22 elementary schools across the selected panchayats and 440 absentees were selected through cluster sampling for the quantitative phase of the study. Due permission from the headmasters of concerned schools was taken before data collection. Data regarding enrolment status, retention status, and causes for absenteeism

were collected through data sheets and structured interview schedules. After the analysis of these quantitative data, the second phase data collection was carried out. For the second (qualitative) phase, 23 students, 18 parents, 16 teachers, and 4 headmasters were selected purposively. They were briefed about nature of the study and the interview process. Consents were obtained from the participants and from the parents of the absentees. After receiving consent for interview and recording, in-depth interviews were conducted through semi-structured interview schedules to identify the causes behind absenteeism and the measures taken to deal with them. The interviews lasted for 37 to 65 minutes (Mean = 48 minutes). Recordings of the interviews were transcribed manually by the researchers.

Data Analysis

The data regarding enrolment and retention obtained from school admission registers and attendance registers, and the data regarding various causes of absenteeism obtained from the absentees through structured interview schedules were analyzed quantitatively through frequency and percentage analysis. The responses obtained from various stakeholders through semi-structured interview schedules regarding the causes and measures taken to address absenteeism were transcribed to textual forms. The investigators went through the transcribed texts several times to get familiarized with the data. Initial codes were created to see the meaning and patterns in these data. Important excerpts were identified and appropriate codes were finalized after several rounds of discussion with fellow researchers and experts. Codes were collated with supporting data and grouped into themes. These themes were then evaluated and revised. Final narratives were written with supporting quotes to back up the points.

Results and Discussion

Enrolment and Retention Status

As per the Odisha Primary Education Programme Authority (OPEPA), if a student remains absent in school for 30 consecutive days, she/he is regarded as dropout. Arrangements are made for her/his readmission if she/he comes to school again. In this study, students remaining absent in school for more than seven consecutive days without prior information, were

considered as absentees. Among the total 5248 students enrolled in the 22 selected schools, 1772 (33.76%) were identified as absentees. Among these absentees, 527 were identified as dropouts as they were absent for more than 30 consecutive days. Out of the total 2926 boys enrolled, 810 (27.68%) were identified as absentees, whereas among the 2322 girls, 962 (41.42%) were identified as absentees. The gender and category-wise enrolment and retention data in elementary schools for academic session 2023-24 are shown in Table 1 and Table 2, respectively.

Table-1. Gender and category-wise enrolment in elementary schools (2023-24)

Category	Boys	Percentage	Girls	Percentage	Total
General	343	6.53	419	7.98	762
OBC	1023	19.49	876	16.69	1899
ST	872	16.62	538	10.25	1410
SC	688	13.11	489	9.32	1177
Total	2926	55.76	2322	44.24	5248

Source: Secondary data from admission registers

Table-2. Gender and category-wise absentees in elementary schools (2023-24)

Category	Boys	Percentage	Girls	Percentage	Total
General	18	1.01	55	3.10	73
OBC	244	13.77	231	13.04	475
ST	302	17.04	347	19.58	649
SC	246	13.88	329	18.57	575
Total	810	45.71	962	54.29	1772

Source: Secondary data from attendance registers

The researchers came up with four overarching themes to describe the factors related to student absenteeism and intervention made by the stakeholders. These themes along with their subthemes have been discussed in detail as follows.

Theme 1: Weak economic condition of families

Kalahandi district, being the part of the Kalahandi-Balangir-Koraput (KBK) region, is considered as one of the most socio-economically underdeveloped areas in India (Banik, 2015). In Kalahandi, the economy of most families revolves around marginal

farming and agriculture related daily-wage labour. Families even struggle to earn their daily bread once the agriculture related earning ceases after the monsoon season. Stricken with acute poverty, families usually prioritize their financial needs and earning livelihoods overlooking the educational needs of their children.

Subtheme 1: Children engaged as earning hands

Varied responses were obtained from the absentees as well as their parents and teachers regarding causes for remaining absent from school. The gender-wise analysis of data revealed that the major reasons behind

absenteeism among girls were engagement in domestic chores (68.27%), agricultural works (18.64%), and taking care of younger siblings (32.33%). On the other hand, in the case of male absentees, the major reasons were found to be engagement in agricultural work (34.58%), domestic chores (12.35%), and farming work (11.87%).

As per the responses received from the parents, 83.33% of them could not send their wards regularly to school. Parents needed a full time member for domestic chores as they were busy at work for the whole day to earn for their family. The marginal farmers, who could not afford paid-workers for agricultural work, engaged their children in such work. One of the parents of an absentee student in Class VIII stated: "Mainly during the monsoon as the agricultural work is at peak, we need manpower in field. From ploughing to harvesting, we do everything manually. Nowadays, the cost for daily-wage labourers is very high and beyond our affordability. That is why, all the members of our family including the children have to work in the field."

Subtheme 2: Compulsion for seasonal migration

Seasonal migration was identified as one of the key reasons behind long-duration absenteeism. It accounted for 17.41% of female and 9.52% of male absentees. Seasonal migration acts as a livelihood strategy for most of the small and nominal farmers as well as the daily-wage labourers due to a lack of employment opportunities once the harvesting season is over. Some parents were found migrating to other states like Andhra Pradesh, Gujarat, Telangana, Tamil Nadu, and Karnataka. This cyclic migration of parents along with their children was found to interrupt schooling of the children for nearly six to eight months every year.

In 2001-02, the Department of School and Mass Education, Government of Odisha, had established seasonal hostels at the source of migration to address the issue of child migration. These hostels provided

free temporary accommodation, food, and healthcare facilities to students whose parents migrate seasonally. However, this facility had not been in operation in most of the migration-prone blocks including Golamunda, which forced school-going children to migrate along with their parents. Especially in the case of the adolescent girls, parents were reluctant to leave them behind in the village (with relatives or neighbours) in concern for their safety. Sharing her experience, the mother of a teenage Class VIII girl revealed: "Once we had left our daughter in the home of one of our relatives so that she could continue her schooling but they neither fed her properly nor did they take proper care during her illness. They engaged her in household work and cooking instead of sending her to school regularly. Moreover, it is not safe to leave the adolescent girls behind as they usually indulge in inappropriate activities at this age."

Theme 2: Lack of aspiration towards education and career among students

In some cases, lack of ambition among the students towards education and career was identified as a crucial factor behind absenteeism. 27.78% of the parents revealed that their adolescent children were addicted to such vices as to chewing tobacco, smoking, and consuming local alcohol along with the older dropout children. Parents often received complaints from the teachers and villagers regarding the involvement of their wards in stealing and street fighting. As a result, few parents voluntarily stopped sending their children to school. Instead, they engaged them in farming work like herding and taking care of the livestock.

Lack of personal aspiration accounted for approximately 8% of absenteeism. Most of the absentees, being the first-generation learners, lacked proper guidance and counselling for education and career related aspects. Neither the parents nor relatives were educated enough to help these children

in setting long-term goals that could have motivated them towards studies and attending school regularly.

Apart from that, around 4% of the absentees did not attend school because of lack of interest in study. The reasons behind their disinterest were inability to understand the lessons, frequent altercation with peers, and fear of punishment from teachers. The father of an absentee in Class VI mentioned: "My son is in Class VI but he cannot even read or write the Odia alphabets. Neither can he perform simple addition or subtraction. I quite often warn him to attend classes regularly till the last period but he always bunks classes after the lunch break to roam and play with his friends and few of his dropout seniors. Sometimes, he pretends to be ill and does not go to school at all. If we send him to school forcefully, he bunks from the first period itself. I scold and beat him frequently, but he is not at all interested to attend school. I reported it to the teachers and headmaster, but no significant action had been taken."

Theme 3: Casual attitude of parents towards children's education

Seriousness among parents towards education of their wards was found to have a significant impact on regularity among children in attending school. Illiteracy and lack of a positive attitude among parents triggered the magnitude of student absenteeism. Parents seldom came to school to attend any meeting or to inquire regarding academic progress of their children. According to 93.75% of teachers, only one or two parents attended the PTA and MTA meetings, that too on an irregular basis. Even

parents, who were the members of the School Management Committee (SMC), had never made any discussion regarding the progress of teaching-learning activities in school. 88.8% of the parents admitted that they had never attended any of the PTA meetings. Only 5.5% of the parents reported that they had approached the teachers and discussed such issues. 38.8% of them had occasionally advised their wards to be regular in school, while 16.6% of the guardians were found using corporal punishment for the same. According to one of the teachers: "Nowadays, the government is providing every facility for elementary level students. From mid-day-meal to free uniform and learning material, students are getting every benefit, but they are still unwilling to come to school. Most of the children come to school for the mid-day-meal only. Parents neither show any interest towards education of their children nor do they entertain any matter regarding this."

These children severely lacked a conducive home environment and parental support that could have motivated them to dream and achieve higher in life. Lack of family support and encouragement had further declined their interest in schooling. One of the absentees in Class VIII expressed: "Now, I am 14. As an earning member of the family, I have to migrate with my parents every year to work in the brick kilns. Previously, while my parents were migrating, I used to stay in my uncle's house for attending school. I was good at study and secured 67% in sixth grade. For the last two years, I have been migrating and seldom get any chance to go to school. My parents are happy that I am earning and taking responsibility. But nowadays, when I go to school, I cannot understand any lesson because of the long duration absence."

Table 3. Various causes behind absenteeism among students

Cause of Absenteeism	Boys (in percentage)	Girls (in percentage)
Agricultural work	34.58	18.64
Domestic work	12.35	68.27
Taking care of siblings	5.76	32.33

Seasonal migration	9.52	17.41
Lack of aspiration	6.29	9.65
Farming	11.87	7.23
Lack of self-confidence	4.36	5.82
Illness	6.39	5.54
Lack of interest in study	4.76	3.29
Overprotection of family	2.53	3.16
Early marriage	0	2.31

Source: Primary data

Theme 4: Inadequate community participation

Despite the intervention made by some teachers, headmasters, and few education-conscious parents, lacunae existed in dealing with large-scale absenteeism. 87.5% of the teachers reported that they had discussed these issues with parents while 68.75% of them personally visited the homes of the absentees to create awareness among parents regarding the importance of elementary education. Convincing the parents through awareness campaigns posed as a major challenge for the teachers because of the prevailing illiteracy.

No significant action had been taken by the parents to mobilize their dropout or absentee children back to school. Moreover, their stereotypical mindset severely impacted the schooling pattern of children. According to one of the teachers: "We need to make the parents aware first and then only they can realize the value of education. They literally do nothing to motivate their children for schooling; instead, they are interested in engaging their adolescent children as labourers on a daily-wage basis. The situation of the teenage girls are even worse; they have to work like an elderly woman and take the whole responsibility of their family in the absence of their parents. Few parents even fix the marriage of their daughters before attaining the age of 18 and justify that training in household chores is more important than formal education."

All the school heads reported that they were frequently addressing the issue of

absenteeism in PTA, MTA meetings and seeking cooperation from the parents, SMC members as well as the local NGOs to sort it out. 75% of school heads revealed that they had enforced compulsory attendance but that too proved ineffective. The key problem encountered by the headmasters in mobilizing most of the absentees back to school was the seasonal migration. The teachers and the headmasters felt the need for frequent organization of awareness programmes for students as well as their parents and guardians. Emphasizing the role of awareness, one of the headmasters mentioned: "Some of the overprotective parents stopped sending their children to school after the COVID-19 pandemic fearing the infection although that had been completely controlled. It clearly indicates a lack of awareness. We have involved the local NGO Lokadrusti to organize awareness rallies. At present, we do not have seasonal hostel facility for the students who migrate, but our teacher association has approached the higher authority to operationalize seasonal hostels in this block."

Previously, the Lokadrusti NGO was active in organizing awareness rallies and providing care-giver system for the left-behind children. But due to lack of funding for the last two years, it curbed its functional purview. Informal interaction with the NGO workers also revealed that some of them were frequently threatened by the local contractors involved in illegal migration of labourers. These local contractors (known as Sardaar) got enraged because of the campaigns organized by the NGO against

illegal migration. Meager remuneration and threat towards life compelled most of the NGO workers to leave their jobs resulting in further decline of operations carried out by the NGO.

Conclusion

Despite the implementation of various programmes under the Sarva Shiksha Abhiyan, large-scale absenteeism is still witnessed at elementary level in rural and backward settings. This failure not only denies children their fundamental right to education but also hinders the nation's aspiration for Universalization of Elementary Education. These students, who remain outside the educational system, are at risk of further social exclusion and deprivation. Moreover, the lack of continuity in elementary-level schooling weakens the very foundation upon which secondary and higher education are built. If students miss out on the critical stage of early learning, the superstructure of advanced education becomes fragile, affecting their overall development and future opportunities.

For recognizing the central role of elementary education, it is essential to address the issue of absenteeism, a major contribution

to the education gap. Absenteeism disrupts students' learning processes, leaving them behind and widening the achievement gap. Therefore, a multi-pronged approach is needed, where parents, teachers, educational administrators, community members, and NGOs come together to take concrete steps to curb absenteeism. These stakeholders can play a vital role by ensuring consistent attendance, fostering a positive learning environment, and addressing the underlying socio-economic factors that cause students to miss school.

Additionally, active community engagement and innovative interventions such as remedial classes, mid-day meals, and school attendance monitoring systems can further encourage regular attendance. The inclusion of marginalized students into the mainstream educational system will require sustained and focused efforts. While it may not be possible to eliminate absenteeism completely, with collective determination and practical solutions, its negative impact can be significantly reduced. By addressing absenteeism, the foundation of elementary education can be strengthened, enabling students to pursue secondary and higher education with confidence and competence. In doing so, the aim of educational equity and empowerment for all can be realized.

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English Medium Instruction in Odisha Adarsha Vidyalyayas: Policies, Practices, and Promise of Quality Education

Sushil Subham Rout

Abstract

The implementation of English Medium Instruction (EMI) by Odisha Adarsha Vidyalyayas (OAVs) aimed to bridge the educational divide and provide underprivileged and rural populations access to high-quality education. In this paper, the author argues that despite its policy driven promises of socioeconomic mobility, English medium education frequently aggravates the pre-existing educational disparities. EMI's official policy and its actual implementation on the ground are examined in this study through semi-structured interviews, focus group discussions, classroom observations and student outcome analysis from OAVs in the districts of Mayurbhanj and Cuttack in the state of Odisha. The statistics show that, despite being taught in English, children commonly experience linguistic estrangement, with teachers resorting to 'unofficial' bilingual approaches to improve comprehension. The technique has proven to be substantially more effective in aiding student learning despite its informality. Through this study, it is argued that the current EMI approach, which encourages instruction in English-only, needs to be re-evaluated. It makes the case for the official integration of bilingual resources assessments and multilingual pedagogies in order to better match students' linguistic realities and attain more equitable learning outcomes. To fully realise EMI's potential in promoting social justice and educational equity in India, the study suggests that policy must change toward a more inclusive multilingual approach.

Keywords: English as a Medium of Instruction (EMI), Odisha Adarsha Vidyalyayas (OAVs), Educational Inequity, Linguistic Diversity, Educational Policy Reform, Social Justice in Education..

Introduction

There have been many discussions, debates, and disclosures regarding the use of English Medium Instruction (EMI) in schools, particularly in postcolonial and multilingual contexts, where English seemed to serve as a global language, as well as a sign of socioeconomic privilege. In a country like India, which is wealthy in variety of languages and has unmatched linguistic diversity, often suffers to make judicious use of the strength, uniqueness, and diversity that each language accompanies. As irrespective of all the language wealth available in the country, English medium instruction is, without a

second thought, regarded as a route to quality education and better professional chances, particularly for those children from rural and poor backgrounds. Sadly, despite such linguistic richness, these languages were never accepted, regarded nor accorded with the value and recognition that they always deserved. Amidst these existing 'medium of instruction-language chaos', Odisha government came up with a model school, named Odisha Adarsha Vidyalyayas (OAVs) under the aegis of Odisha Adarsha Vidyalaya Sangathan (OAVS). It is an ambitious initiative by the Government of Odisha to provide quality education in English medium to the rural children of Odisha, practically

at no cost or at best at low cost. They have a network of state-run model schools, which imitates this policy approach, by using EMI as an effort to provide better educational opportunities to less privileged students of the society with the declared goal of bridging and gradually overcoming socioeconomic divides that exists within in a layered manner. However, despite all the promises of quality education and social mobility, the real-life implementation of EMI in these institutions shows a substantial level of pedagogical and sociolinguistic challenges, which requires more probing in the form of investigation. The English as a medium of instruction is often marketed, promoted, and sold to the society and its constituents as a progressive step in modernising education. However, its use in places where English is not the primary language of communication raises potential questions about linguistic isolation, accessibility, and learning outcomes. According to research, children who come from non-English speaking backgrounds often have trouble understanding in EMI settings which frequently results in a greater reliance on rote memorisation rather than meaningful engagement with academic discourse. Moreover, this pattern is evident in OAVs where students who have had limited exposure to English beforehand, find it difficult to understand complicated subjects, undercutting the overarching objective of delivering high quality education. It is also difficult for teachers, many of whom received their training outside of EMI (non-EMI settings), to teach entirely in English while ensuring that students understand. As a result of which, a widespread informal dependence on bilingual teaching methods has arisen to tackle such contexts, with teachers routinely moving between English and students' home languages to promote learning. Even though this multilingual strategy works well in reality, but, at the same time, it contrasts sharply with the legally mandated English-only model, demonstrating a fundamental mismatch between policy goals and classroom realities.

The drive for EMI in OAVs corresponds with a global movement that views English as a means of promoting economic growth and upward mobility. However, such a method sometimes ignores and fails to acknowledge the reality that language is not only a tool for education but also a crucial factor in determining access to opportunities, possibilities, and knowledge. Treating language merely as a neutral vehicle of instruction obscures its role in reproducing or challenging existing social, economic, and educational hierarchies, particularly in marginalised rural schooling contexts such as OAVs. Bourdieu's concept of 'linguistic capital' provides a useful framework for understanding this phenomenon, demonstrating how English, as a prestigious language may both facilitate and hinder socioeconomic advancement. In this study, linguistic capital is understood as the socially recognised value of particular language competencies within institutional and educational spaces, where English operates as a legitimised resource that can be converted into academic recognition and social mobility, while vernacular and tribal linguistic resources are rendered invisible or devalued. In the case of OAVs, the children from lower socio-economic backgrounds were seen to frequently lack the linguistic base required to properly benefit from EMI instruction. Rather than promoting inclusivity, EMI may in some situations unintentionally aggravates educational inequalities by favouring students who have had prior exposure to English. Furthermore, Cummins interdependence hypothesis argues that students' performance in a second language improves when they have a strong foundation in their first language. The absence of students' home languages from formal instruction as observed in OAVs, goes against this ideal and may obstruct cognitive growth and academic progress of the students, going strongly against the very idea and vision of 'providing quality English medium education to the rural talents of Odisha.'

The recent multilingual educational research questions the strict enforcement of EMI policies and support for more flexible approaches that take advantage of children's entire linguistic potential. The theory of translanguaging, for example, argues that pupils learn more efficiently when they can seamlessly integrate different languages into the learning process. In OAVs, teachers' informal use of bilingual methods shows that translanguaging practices occur spontaneously, upholding the idea that a solely English medium model is not only unfeasible, but also impedes instructional effectiveness. Whereas other multilingual studies have found that bilingual and multilingual education improve topic comprehension as well as language acquisition and these findings raise serious doubts regarding the long-term viability of an 'English-only' instructional method in OAVs. The disparity between EMI policy and the actual grassroots level execution is most visible in the area of assessment. Students are expected to demonstrate the topic knowledge in English, regardless of their competence level, which raises further challenges, as students with a great grasp of topic concepts, frequently fail to explain their comprehension due to their linguistic limits. The overemphasis on English in evaluations disadvantages non-native speakers and nurtures structural inequities, as pupils from more privileged linguistic backgrounds are more likely to succeed than the disadvantaged sections of the society – disadvantaged both linguistically and economically. Given these problems, there is a dire need to reconsider the EMI paradigm in OAVs and research more inclusive approaches that are aligned with students' linguistic reality.

The purpose of this study is to critically analyse the influence of EMI or EME (English Medium Instruction/Education) in OAVs by looking into how students and teachers deal with linguistic problems in an English dominated academic environment. The study uses semi structured interviews, focus group discussions, classroom observations,

and an analysis of student performance across OAVs in Odisha's Mayurbhanj and Cuttack districts to give an empirical basis for understanding EMI implementation. Two Odisha Adarsha Vidyalayas were purposively selected for in-depth study, representing a rural-tribal context (Mayurbhanj) and a semi-urban context (Cuttack). Participants included school administrators, subject teachers, students from Classes IX and X, and parents of first-generation learners' households and comparatively educated households, allowing for a multi-layered understanding of EMI as policy and practice. The study focuses on three key questions: (a) whether EMI promotes or hinders educational equity, (b) how teachers adapt their teaching methods to bridge language gaps, and (c) what policy level changes might be necessary to align EMI with students' actual learning needs.

A core argument of this paper is that a rigid EMI model, particularly in contexts where English is not the first language of students, may worsen educational disparities instead of reducing them. Rather than enforcing an English-only approach, a more balanced model, one that incorporates multilingual teaching methods, bilingual learning materials, and flexible assessment strategies, would better serve the goal of 'quality education.' Achieving all of this, however, requires a change in the policy perspectives by moving away from a 'one-size-fits-all' approach, to one that acknowledges the diverse linguistic and educational backgrounds of students enrolled in OAVs.

The remainder of this paper is structured as follows. The next section provides a comprehensive literature review, exploring global and national debates on EMI, theories of language learning, and empirical studies on multilingual education, followed by a detailed discussion of the research methodology, which includes the data collection methodologies and analytical frameworks employed in the study. The findings section, then explores important understandings gained in the form insights

from classroom observations, student and teacher interviews, and academic performance patterns in EMI contexts. The discussion section situates these findings within the larger theoretical and practical concerns surrounding language and education. Finally, the conclusion part and policy recommendations outline prospective reforms by stressing upon the importance of a more contextually aware and linguistically inclusive approach to EMI in OAVs.

The implementation of English medium instruction in OAVs provides a thoughtful but difficult attempt to address educational discrepancies through language policies. Although, 'English' as well as 'English medium instruction' is often seen as a most sought out way to improve educational and professional prospects, but its performance is determined by how effectively it accommodates the linguistic realities of both students and teachers. By scrutinising the limitations of an English-only approach and advocating for a more inclusive multilingual approach the findings of the study contribute to ongoing discussions about language and education policy. Through focusing on the experiences of students and teachers in EMI classrooms, this study stresses upon the importance of re-evaluating and further re-considering language policies to ensure that it supports both educational equity and results in meaningful learning outcomes.

Literature Review

The English medium instruction, over a period of time, has grown exponentially as a phenomenon worldwide, due to its perceived role in promoting economic mobility, global competitiveness, and access to higher education (Dearden, 2015; Hamid et al., 2019). At one hand, the policy discourses constantly describe EMI as one of the potential ways towards socioeconomic growth. However, at the other hand, research shows its pedagogical hurdles, linguistic barriers, and propensity to aggravate educational inequality (Macaro

et al., 2018; Phillipson, 1992). In the context of India, policies on EMI in public education, particularly in Odisha Adarsha Vidyalayas follows global trends by displaying distinct sociolinguistic difficulties (Mohanty, 2013; Panda & Mohanty, 2014). The section thoroughly evaluates the major literature on EMI, theories of language acquisition, and practical studies on multilingual education, drawing from international perspectives and contextualising the current study's contribution.

Theoretical Perspectives on EMI and Language Learning

There are several theoretical assertions that support the discussion of EMI, particularly in multilingual contexts. Bourdieu's (1991) concept of 'linguistic capital' is useful in understanding EMI's function in nurturing and thereby continuing to maintain the socioeconomic disparities. English, as a dominating 'linguistic currency,' often favours the students who belong to privileged backgrounds while marginalising others with minimal or no exposure to the target language (Tollefson and Tsui, 2018; Ricento, 2015). In the educational system, like that of India's, EMI is viewed as both a boon and bane; a source of mobility, as well as a potent source of linguistic alienation, for students from rural and marginalised communities, failing to understand curriculum taught in an unfamiliar language. A language, that's if not alien but is unfamiliar to the students' life, culture, immediate surroundings and largely their being and becoming (Eldho, 2020; Rout, 2024).

Cummins (1979) interdependence hypothesis proposes that students' ability in a second language (L2) improves when they have a sturdy basis in their first language (L1). However, this notion goes against the idea of monolingual EMI policies, which ignores the cognitive benefits of bilingual education (Garcia & Lin, 2017; Skutnabb-Kangas, 2008). The translanguaging theory, as advocated by Canagarajah (2012), opposes the tight compartmentalisation of

languages in education by advocating for the instructional practices, that considers and uses students' complete linguistic repertoires. There are even several research which indicate that using translanguaging in EMI settings enhances one's understanding and cognitive engagement (García & Wei, 2014; Wei & Lin, 2019), supporting need based, multilingual instructional approaches in OAVs.

Global Perspectives on EMI Implementation

The spread of EMI across different educational contexts has resulted into variety of possibilities and difficulties, concerning 'language' and its usage inside and outside the classrooms in educational setups. English medium instruction is frequently associated with internationalisation and academic prestige in European higher education (Wilkinson, 2013; Dimova et al., 2015). However, there are adequate research that show EMI poses challenges for comprehension and participation of students, particularly for the non-native speakers of English (Dimova et al., 2015; Bälter et al., 2024). Similar sort of patterns can be seen in East Asian contexts where the adoption of EMI has been met with reluctance due to worries about students' language preparation and teachers' ability in English (Lei & Hu, 2023).

In Sub-Saharan Africa, EMI policies have been criticised for aggravating educational indifferences, as students with insufficient exposure to English mostly struggle to grasp the subject matter (Brock-Utne, 2013; Heugh, 2008). Studies in South Africa, show that EMI has constantly disadvantaged indigenous language speakers, resulting in inferior academic achievement and higher dropout rates (Probyn 2009; Chalmers 2019). These findings are also consistent with research in Latin America, where the projects of EMI have struggled due to improper yet insufficient teacher training and a lack of pedagogical support (Banegas, 2021; Lopez & Sichra, 2008).

EMI in the Indian Context

Undisputedly, one of the main reasons for difficult adoption of EMI is due to the linguistic diversity that a nation like India possesses. At times, these diversities rather than being helpful, creates obstacles for an effective and complete EMI adoption. There are researchers that claim, EMI policies in public education often are seen to benefit the urban and economically sound populations, while it disadvantages rural children (Mohanty, 2013; Panda & Mohanty, 2014). Research in higher education in India shows that EMI leads to linguistic inequality with students from English speaking backgrounds outperforming those from vernacular medium institutions (Azam et al., 2013; Jhingran, 2005). According to Ramanathan (2005), students from non-English-speaking households mostly are seen to struggle with comprehension and academic engagement.

Within Odisha's OAVs, EMI is positioned as a means to enhance educational quality and socioeconomic opportunities for marginalised students. However, preliminary research signifies that teachers frequently resort to bilingual instruction to facilitate comprehension (Rout, 2024; Khubchandani, 1997). This comes in alignment with broad ranging national findings where teachers, despite official EMI mandates, rely upon code-switching and code-mixing to fill in the void of linguistic gaps (Agnihotri, 2009). Such practices challenge the effectiveness of strict EMI policies and accentuate the need for multilingual pedagogies in Indian classrooms (Panda & Mohanty, 2014; Skutnabb-Kangas, 2008).

Pedagogical Challenges and Bilingual Strategies in EMI Classrooms

Teacher preparedness and instructional strategies considerably influence EMI outcomes. Research suggests that many EMI teachers lack sufficient training in English proficiency and subject-specific pedagogical methods (Lasagabaster & Doiz, 2016; Galloway et al., 2021). In India,

there are studies that show that teachers often experience linguistic insecurity when required to teach complicated subjects in English, leading to reliance on bilingual methods (Menon et al., 2018; Rout, 2024). The effectiveness of these informal bilingual strategies is supported by empirical studies demonstrating that students achieve better learning outcomes when the informal, yet formal instruction incorporates their home languages (Heugh, 2008; Hornberger, 2004).

Multilingual Pedagogies and Policy Considerations

The limits of EMI have led to proposals for legislative and policy level changes that incorporate multilingual pedagogies. Several studies from countries like Canada and Finland provide with insider's perspective about the advantages of dual language education approaches, which improve both topic learning and language ability (Ricento, 2015). Empirical research from Ethiopia and South Africa also suggests that additive bilingualism, in which the first language is gradually phased out rather than abruptly replaced, leads to improved academic performance and linguistic competence.

In India, the experts unanimously argue for a more balanced EMI strategy that considers students' linguistic roots while improving their English competence (Eldho, 2020). The National Education Policy (NEP) 2020 emphasises the importance of mother tongue-based education, however the consequences for EMI schools are uncertain. Research suggests that EMI policies should adopt a framework that is more inclusive, one that legitimises bilingual instructional practices and provides structured teacher training in multilingual pedagogies (Panda & Mohanty, 2014; Skutnabb-Kangas, 2008).

The worldwide and national literature on EMI emphasises the challenges of implementing English-dominant educational paradigms in multilingual communities. The paper adds to the continuing discussion about EMI policy and practice by combining lessons from global research and proposing for

pedagogical methods that embrace rather than marginalise linguistic diversity.

Research Methodology

The study employs a qualitative case study methodology to examine how English medium instruction is being implemented in Odisha Adarsha Vidyalayas. It focuses on the perspectives and experiences of key stakeholders, pedagogical challenges and sociolinguistic ramifications of EMI in this setting. Since, it allows for a nuanced analysis of a real-world issue in its natural environment, a case study approach is ideal for this research (Yin 2018). An organised yet adaptable framework for investigating the policy-practice gap in EMI from various angles is provided by a case study in contrast to ethnography which requires substantial fieldwork or phenomenology which concentrates on individual lived experiences. This study looks at OAVs in the districts of Mayurbhanj and Cuttack in order to evaluate in detail how EMI is used in classrooms and how different stakeholders perceive and understand its effects on learning outcomes, especially for marginalised students from rural non-English speaking communities.

Guided by this objective, the research is structured around four key questions: (1) How do key stakeholders – policymakers, teachers, students, and parents – perceive the implementation of EMI in OAVs? (2) What pedagogical and socio-cultural challenges emerge as a result of EMI adoption, particularly for marginalised students? (3) How do bilingual pedagogical strategies impact student learning outcomes in EMI classrooms? and (4) How do EMI policies in OAVs align with national multilingual education frameworks, and what implications does this have for larger educational practices in India? These questions make a subtle attempt to understand the complexities surrounded by English medium instruction from a variety of perspectives, encompassing multiple angles which capture both its potential benefits and

inherent challenges within Odisha's socio-linguistic context.

Purposive sampling is used in this study to ensure the inclusion of different perspectives, specifically targeting persons directly involved in EMI implementation. The participants were chosen based on their responsibilities in policymaking, administration, teaching, and learning, as well as their socioeconomic and linguistic status. The sample included policymakers, who provided insights into the rationale and objectives of EMI policies; the teachers were chosen based on their years of experience, subject expertise, and familiarity with bilingual teaching strategies; whereas, the students were drawn from both rural and semi-urban OAVs, ensuring representation of different socioeconomic backgrounds and levels of English proficiency; and parents, particularly those of first-generation learners, whose perspectives offered different dimensions.

The study uses a variety of qualitative data collection approaches to obtain a thorough and triangulated knowledge. Semi-structured interviews with the administrators, teachers, and parents provided a detailed understanding into their experiences and issues with EMI. The semi-structured interviews gave participants the flexibility to freely express their thoughts, while it also enabled the researcher to elicit stronger and layered insights. Further, Focus Group Discussions (FGDs) were held with students and teachers to brainstorm as well as analyse EMI issues and the effectiveness of multilingual solutions in the classroom. These FGDs facilitated the development shared thoughts which lead to lively discussions, which lately enhanced the study's findings.

Furthermore, classroom observations were carried out across the two OAVs. One in rural-tribal setup of Mayurbhanj and the other one in a semi-urban setup of Cuttack districts, to get first-hand knowledge of teacher-student interactions, the usage of multilingual methods, and student involvement in EMI classes. The observations focused on how

teachers dealt with linguistic obstacles, how students reacted to English-medium education, and whether bilingual pedagogical practices were implemented effectively or not. In addition to all these methodologies, document analysis was used to analyse policy documents, curricular guidelines, and instructional materials, determining whether official EMI mandates are consistent with classroom realities. By considering and eventually merging these many data sources, the study ensures a comprehensive and multidimensional investigation of EMI implementation in OAVs.

This study employs data triangulation, which entails cross checking the findings from multiple sources to increase reliability and credibility. To make sure that reported challenges and experiences aligned with real teaching-learning scenarios the triangulation technique involved comparing policy language (from interviews with administrators) with classroom realities (from focus group discussions and observations). Furthermore, the perspectives of both teachers and students were validated through classroom observation data allowing for a comprehensive validation of pedagogical issues. In order to elucidate on the socioeconomic ramifications of EMI, parental opinions were examined alongside student engagement and achievement. Using a triangulated method like this reduces researcher bias while ensuring that the conclusions are both culturally grounded and empirically supported.

To identify patterns and themes in the qualitative data, the study employs thematic analysis (Braun and Clarke 2006). The first step in the process was data familiarisation, which entailed closely going over focus group discussions, observation notes, reviewing interview transcripts and policy documents to uncover underlying emerging trends. This was followed by first coding, in which major phrases and ideas were classified. Related codes were then organised into broader categories, such as teacher preparedness, student involvement, linguistic difficulties,

and socio-cultural challenges. Finally, the themes were modified and interpreted to guarantee their consistency with the study questions, allowing for a detailed and a thorough examination of EMI implementation in OAVs. To enhance transparency in reporting qualitative findings, indicative counts of participants expressing similar or contrasting perspectives were included alongside illustrative quotations. Such an approach does not necessarily quantify the data but provides readers with a sense of the prevalence of certain views across stakeholder groups, strengthening the credibility and interpretability of the reported themes.

Throughout the entire research process ethical considerations were given the topmost priority. All participants gave their informed consent, acknowledging that they understood the purpose of the study that their participation was voluntary and that they could withdraw at any time. Parental consent was obtained from student participants as well. All responses were anonymised using pseudonyms to protect participant identity and they were kept completely confidential. Furthermore, given the hierarchical nature of schools, special efforts were taken to reduce power imbalances, particularly when dealing with students and teachers. The FGDs were conducted in non-administrative informal settings, where participants could freely express and voice their opinions without the fear of institutional repercussions. Data collection was done in Odia, English or a combination of the both the languages, to accommodate the linguistic diversity of the participants and allowing them to freely express their experiences.

Using a case study methodology and several qualitative methods, this study gives a comprehensive, and in depth probing of EMI implementation in Odisha Adarsha Vidyalayas. The study tries to add to the ongoing academic conversations about EMI and multilingual education, while also providing practical yet useful insights for policymakers and educators, stressing upon the importance of context sensitive

instructional practices. The findings of this study have the potential to inform and guide future policy interventions, ensuring that EMI policies are inclusive, pedagogically sound, and in alignment with the linguistic realities of rural students in India.

Findings and Results

The findings of the study are based on a range of data sources, such as semi structured interviews with educational administrators and policymakers, interviews with teachers, focus group discussions with parents and children, classroom observations, and even document analysis. These findings are presented topically, with full excerpts from participant responses, theoretical connections, and broader policy consequences, to provide a thorough analysis of the upsides and downsides of the EMI programme in urban and rural Odisha.

1. Rationale, Objectives, and Challenges of EMI in OAVs

Administrators' Perspectives

The implementation of EMI in OAVs was billed as an educational programme focused at providing marginalised students with equitable opportunities for achievement in higher education and the labour field. The administrators emphasised that the fundamental goal of EMI was to bridge the rural-urban gap by providing English-education and improving the English proficiency of pupils from underprivileged areas. Making English the medium of teaching was thought to better prepare students for the challenges of globalisation and ever evolving competitive job markets. This aspirational framing was expressed by five of the seven administrators interviewed, who associated English proficiency with social mobility and global participation. According to an administrator:

“In today’s modern world, having proficiency in English opens millions of doors. OAVs are noble institutions

with pious motives, established for the betterment of poor children of the society; as it aims to provide rural students with the English skills, which is necessary to compete on an equal footing with their privileged peers. EMI and the quality in EMI are core to this vision. Else, tell me where you would get free English medium schooling? In this mean world where money is the fuel to run the vehicle of one's life. Do you think something being free can associate itself with quality? I would advise everyone to try enquiring about the fees that the private institutions charge to disseminate EME. Even the wealthier among the wealthiest thinks twice before getting their children enrolled to a school equipped with EMI in a rural setup, and these dynamics change with the city, locality and the society. Just forget about the underprivileged portion of the society!" (Dipak, Administrator, OAVS)

Similar views linking English-medium provision to equity and aspiration were expressed by four other administrators, indicating a strong convergence of perspectives within this stakeholder group. Despite the aspirational intentions, many considerable difficulties arose during the implementation of EMI. The administrators acknowledged that teacher readiness, student adaptability, and the sociolinguistic reality of rural communities posed tremendous challenges. Another administrator reflected:

"It is an easy task to implement a policy on a piece of paper, but the reality will leave you with a mouth wide-open, that many of these students come from homes where English is hardly spoken and barely understood; many of them come from tribal families, where even the dominant L1 of the state, i.e., Odia, is not completely taken into account nor understood; most of them are first generation learners. When they enter OAVs, they face a huge leap, and often, the gaps in their understanding

of the subject matter are widely stark." (Rabindra, Administrator, OAVS)

These implementation-level concerns were shared by six of the seven administrators interviewed, indicating near-consensus about the structural and pedagogical difficulties involved in realising EMI in rural and tribal settings.

These findings are consistent with Bourdieu's (1991) theory of linguistic capital, which proposes that language proficiency is related to one's social and economic standing. The policy's notion that EMI will automatically lead to upward social mobility is impaired by first-generation learner's linguistic estrangement in rural as well as urban settings. In the absence of an adequate transition mechanism, the implementation of EMI may without any intention worsen the existing 'language-chaos' rather than alleviate educational inequity.

2. Teachers' Experiences with EMI Implementation

Confidence and Preparedness

The teachers' experience with EMI showed a complicated picture of concern and dedication. Many of the teachers expressed anxiety about their own English proficiency and teaching methods, while English language teachers were generally confident in their ability to deliver content in English, teachers of Science and Social Science expressed significant difficulties in using English for academic terminology and tackling complex subject matter. Concerns related to language proficiency and pedagogical preparedness were expressed by seven of the twelve teachers interviewed. One Social Science teacher shared his experience:

"Teaching political theory in English is very challenging. The concepts are complex in nature, and my students often complain about and struggle with the terminology. Even when I try to translate terms, it doesn't always help because they don't have the context for understanding." (Jagannath, TGT—SST, OAV, Cuttack)

Similar concerns were expressed by three other teachers (two Science teachers and one Social Science teacher), indicating that technical vocabulary posed recurring classroom challenges.

Many teachers acknowledged that the transition to EMI required a thorough yet complete rethinking of their pedagogical practices, but they often felt unprepared to make such a leap. Feelings of unpreparedness were reported by six of the twelve teachers. A senior teacher in the Science department shared her experience:

“In Science, many of the terms are new to the students, and teaching them solely in English is overwhelming. I find myself reverting to Odia to ensure they understand the concepts properly. If they still don’t understand, I try to provide them relevant examples. If they fail to understand that too, I leave them to the ‘creator of English’ and pray to God for their good sense and educational prosperity. In a class of 35 minutes, I can’t cater to all these discrepancies, sadly. We are bound to meet the deadlines of completing the syllabus by hook or crook. The students who come from previous backgrounds of English schooling, get along with us, while most of the children from vernacular medium, fail to comprehend and are usually left behind.” (Sanjukta, PGT Science, OAV, Mayurbhanj)

Similar classroom disparities were reported by four teachers, particularly in mixed-ability classrooms.

Classroom Strategies— Bilingualism and Code-Switching

Faced with these challenges, bilingual pedagogies became a common strategy in classrooms. Many teachers adopted code-switching and code-mixing as a pragmatic solution to ensure that students could access the curriculum. The use of bilingual strategies was reported by eight of the twelve teachers. In Social Science and Science

classes, teachers often began their lessons in English but switched to Odia to explain difficult concepts. One Science teacher noted:

“I start in English, but if I see the students struggling, I switch to Odia to reinforce key ideas. Without this, they wouldn’t be able to follow the lesson at all.” (Aparna, TGT SST, OAV Mayurbhanj)

This practice of bilingual scaffolding imitates Garcia and Lin’s (2017) concept of translanguaging, which emphasises the fluid movement between languages to enhance comprehension and learning. Similar practices were described by five teachers.

The reliance on bilingual strategies stands in direct contrast to the rigid EMI mandate, which assumes that English-only instruction will guarantee better educational outcomes. Concerns about this policy–practice gap were articulated by four of the twelve teachers. This gap between policy and reality emphasises the importance of a multilingual instructional approach in which both English and the student’s mother tongue are employed to assist deeper understanding.

3. 3. Students’ Experiences and Challenges in EMI

Comprehension and Academic Performance

Students in OAVs reported extensive difficulties when it came to understanding English, particularly in courses that required specialised knowledge, such as science and social science. Many students reported that classes were much simpler to understand when delivered in Odia, most of their first language (L1), while the L1 of the students coming from different tribes, speaking different tribal languages such as Ho, Santali, Mundari, etc. remains another grave concern. A ninth-grade student expresses his frustration:

“In Science, when the teacher uses English to explain everything, I feel

lost. But when he explains in Odia, I can understand much better. It feels like home! As if, my mother is teaching me the concepts, similar to the ways she instructs me in a simplified manner to carry out a certain task with ease, making sure that I accomplish it, without fail" (Chumanu, Class-IX, OAV, Mayurbhanj)

Similar experiences of improved understanding through Odia were reported by six other students, indicating that language of explanation strongly shaped classroom comprehension.

This was a typical experience for many students, and it accentuates a major challenge of EMI in OAVs: the language barrier is not just a surface barrier, instead it is a profound one, that prevents students from totally engaging with the programme. A student in the tenth grade shared:

"I like English, but in subjects like Science, I don't feel I'm learning much when everything is in English. It's like I'm left with nothing but an only choice of memorising words without understanding them. And, the moment I try to speak, I fumble and forget. Similarly, in the examinations, I manage to write all that I mugged up, at once and as soon, I leave the examination hall, I forget all of it. Fortunately, this is not the case with Odia. I happen to remember, the concepts that were taught and further understood in Odia, than in English. If you ask me, about 'The Thief's Story' taught from the book 'Footprints without feet— A Supplementary Reader' I can tell you the whole story fluently in Odia, but I can't in English. I can even answer to all of your questions in Odia Language but answering the same in English becomes difficult for me, I become shy... I get afraid of committing mistakes." (Shreemayi, Class-X, OAV, Mayurbhanj)

Such patterns of rote memorisation without comprehension were described by five of the

fourteen students, particularly in content-heavy subjects.

Among all the subjects, English was the only subject where majority of the students reported improvements in their language proficiency and the difficulties varied by subject. However, other subjects like science and social science showed substantially more obstacles because they frequently require abstract concepts and specialised vocabulary that students are unfamiliar with in English. However, the EMI's assurance of improving subject mastery often collided with the realities of subject specific knowledge. Challenges in Science and Social Science were described by eight of the fourteen students, who associated these difficulties with abstract concepts and unfamiliar technical vocabulary.

The loss of subject clarity was most noticeable in technical subjects, where practical demonstrations were essential for concept formation. One of the students said:

"I love doing experiments in science, but when the teacher explains everything in English, I don't enjoy it at all. I feel disconnected. However, when explained in Odia, I enjoy it, as I get to understand the tone, tenor, and meaning, while in English, I find everything to be monotonous and flat. The fun and comprehension that comes along when our Sir/Ma'am speaks in Odia can't be replaced by any other language. Our teachers even enjoy teaching in Odia, we can see their energy, their hand movements, it's unmatched. They make us laugh and joke around by giving us different kinds of relevant examples. Sadly, while teaching in English, most of them become serious and look dull and uninterested like us—the rest of the class." (Ridhiman, Class-IX, OAV, Cuttack)

Concerns about reduced engagement and enjoyment under EMI in technical subjects were reported by four students.

All of it discussed above, accentuates a conflict between the English exposure provided by

EMI and the potential loss of engagement and subject expertise in disciplines requiring conceptual clarity. Several students (seven of the fourteen students) perceived that EMI, when implemented without regard for their cognitive and linguistic needs, may harm rather than help their learning experiences. There are high chances that EMI may mistakenly harm rather than help student's learning experiences, specifically when it is done without any regard for student's cognitive needs.

4. Parental Perceptions of EMI

The views of parents toward EMI were diverse in nature. Many of the parents saw the introduction of English as a path to greater employment options for their children, believing that competence in English would improve their children's chances of finding good jobs later in life. English was associated with elitism and better life prospects. Aspirational views of English were expressed by eight of the thirteen parents interviewed. A tribal mother from the rural area of Mayurbhanj expressed:

"I want my children to study only in English language because I can sense it will be beneficial for them to procure a good job. But I am disappointed to see them struggling to understand the lessons. No matter what they only speak in Odia at home and even the school. I have never seen the masters even conversing in English, neither with the children nor among themselves, after the class. If they don't do, how will our children pickup English? If they don't speak English, then what's the point of sending them to English medium schools? Odia medium schools are equivalent in that case. I see no change." (Phulabati, Housewife cum Tailor, Mayurbhanj)

Concerns about children's comprehension despite high parental aspiration were shared by five other parents.

At the same time, many parents expressed their anxieties about their inabilities to

facilitate their children's learning at their respective homes, owing to their educational backgrounds and weak or negligent English proficiency. This concern was expressed by seven of the thirteen parents. A father on an emotional note explained:

"I fail to provide support to my child with her homework because I myself an illiterate, forget about knowing English. English was meant for the elites; I can't read and write Odia properly. She has no one to consult at home, there is no one to guide her and I worry about her falling behind. Being a taxi driver, I am so helpless that I can't even afford good tuition classes for her. We are afraid of planning for another child. We are unable take care of one, how can we take the load of the other child. A good education has become expensive for small workers like us. All of us know that good schooling and education is provided at the English medium schools only, and it becomes a distant dream for us." (Radhu, Tempo-driver, Cuttack)

These criticisms show an intergenerational linguistic barrier that EMI does not address. Similar experiences of limited parental support at home were reported by six other parents.

At the same time, it shows the linkage of aristocracy in the form of elitism associated with a particular language, i.e., English, while the vernacular ones are considered as incompetent and meagre one for the rest of the masses. This perception was articulated by five of the thirteen parents. It is like buying that 'rice' which a well-off man buys from the supermarket paying around 100 rupees per kg, while the working class from the lower strata can only think about it, often left to relying upon the 'rice' that is provided to them for two rupees under the Below Poverty Line (BPL) scheme of Odisha government. The above circumstance can straightway be equated to the availability and access of schools to different working classes in Odisha. A

similar kind of experience takes place with schooling and English medium education in Odisha, and lately in India. The ones who have a strong access to all the three forms of capital discussed by Bourdieu, i.e., economic, social and cultural capital, often gets the access to 'a good English medium education system,' while the rest of the crowd is left to gamble on luck and hard work in the name of 'entrance tests,' allowing a selective access, intake and participation. Perceptions of selective access based on class were expressed by six of the thirteen parents. Connecting back to the anecdote, while pupils are exposed to English in the classroom, a lack of parental support at home, particularly in rural areas where many parents have no formal education, adds another degree of challenge. This difference can lead to student alienation and academic disengagement, increasing the difficulties caused by EMI. Such concerns were articulated by seven of the thirteen parents. The above concerns align with Cummins' (2000) Interdependence Hypothesis, which argues that students' first language (L1) plays an essential role in their ability to acquire a second language (L2). The lack of a bilingual bridge in EMI models, where both L1 and L2 are used in tandem, may accidentally hinder cognitive development, for first generation learners.

5. Classroom Practices and Student Engagement

The classroom observations carried out depict a mixed approach to EMI across OAVs. While some of the English classes adhered strictly to the EMI model with teachers conducting lessons entirely in English, Science and Social Science classes saw more flexibility, with teachers frequently switching to Odia to ensure comprehension of the classroom discourse. This pattern of mixed practice was observed in nine of the twelve classrooms observed. Interestingly, the participation of the students was viewed to be particularly low in classes where mostly only-English was used. Low levels of student participation

under English-only instruction were observed in seven of the twelve classrooms. As an observer, the author noted:

"In those classes where the teachers mostly used only-English for teaching, the students were seen to be laid back cluelessly. They were quieter, uninterested, and seemed more passive. But whenever the teachers switched to Odia (dominant L1), participation increased, and the class became lively. The exchange happened both ways, debunking the often-common notion of teacher pulling a one-man-show!" (Author, Field Observation Notes)

The above observation shows a disconnect between the rigid EMI policy and the actual classroom practices. This policy-practice gap was evident in eight of the twelve classrooms observed.

The English-only approach appeared to alienate students, making them passive rather than engaged participants in their learning. The necessity of bilingual approaches to teaching, where both English and Odia are used strategically, was evident in almost all classrooms observed.

6. Policy and Curriculum Alignment

Document analysis showed pertinent gaps between the policy's aspirations and its practical implementation. The policy documents stressed upon the use of EMI as a tool for enhancing global competitiveness, with a meagre consideration for the linguistic diversity of the student body. Additionally, the curriculum materials were found to be overwhelmingly English centric, providing minimal time and accommodation for language transition. A fundamental shortcoming, or rather an essential gap seen, was the lack of multilingual teacher training, which would have been required for the proper implementation of EMI. The official policy materials while positioned EMI as a universal equaliser, but the reality on the ground discloses a lack of structured support mechanisms to help students and

instructors negotiate the hurdles of an English-only educational model.

7. Future Directions for EMI in OAVs

Administrators expressed their commitment to improving EMI in OAVs but noted the need for adaptive techniques to make its implementation more effective. Out of the six administrators interviewed, five administrators expressed strong concern that the present model of EMI required flexibility, while one administrator viewed the current implementation as largely adequate. An official explained:

“All of us would agree that the policy is undoubtedly well intentioned, as it envisions to do better for the rural societies of Odisha. However, for that to happen, we need better teacher training and a more flexible approach. The EMI should not lead us to linguistic exclusion, as we need to support students in their transition to English. The idea is to support and help them succeed, not to leave them stranded all alone and become a burden for their respective families.” (Binod, Principal, OAV Mayurbhanj)

Most of the teachers that we encountered and exchanged words with recommended a slow and gradual appropriate approach of EMI implementation, where exposure in English is gradually expanded by beginning in the early grades while the students’ first language is strongly supported. Out of the 14 teachers interviewed, 11 teachers favoured a gradual and scaffolded EMI model, while three teachers supported a faster and more immersive English-only approach. A teacher said:

“In my opinion all of us should effectively start teaching in English from the lower grades, it becomes easier for both the teacher as well as the students, and then gradually increase the usage of English. This way students will not feel overwhelmed,

and we are able to continue to support them with Odia. What happens, from Class VI onwards they are neglected, while also promoted. The language teachers should ensure that the child meets the minimum requirements of learning and competency before being promoted to the next class. Often, a derailment and neglect from the earlier classes results into such scenarios of ‘academic helplessness.’” (Parvati, PGT English, OAV Cuttack)

The recommendation is consistent with Baker’s (2011) theory of bilingual education, which promotes progressive immersion as a more successful alternative to a rapid transition to EMI. Such a methodology would not only reduce students’ cognitive load but also offer them with a more sustainable path to bilingualism.

The findings show the complicated tangle between aims of the EMI policy and its practical difficulties. Although, EMI holds the potential to expand educational opportunities, its implementation in OAVs has been obstructed and hampered by linguistic realities, teacher training issues, and socioeconomic discrepancies, as reported by a majority of administrators (five out of six) and a majority of teachers (eleven out of fourteen). Through this study, we stress the importance of a multilingual instructional framework that thoroughly, in a meticulous manner, incorporates both English and students’ mother tongues to provide inclusive and fair education.

The success of EMI in OAVs is dependent on policymaker’s willingness to understand the nitty-gritties of the classroom realities and apply research based adaptive interventions to work out the problems in a meticulous manner. It is only with a context sensitive approach, that includes bilingual education practices, increased teacher training, and progressive language transitions towards EMI, one can genuinely address the concerns and issues of language equity in rural Odisha, promoting educational fairness.

Discussion

The findings of the study clarify and explain the implementation and impact of English medium instruction in Odisha Adarsha Vidyalayas, particularly in the rural districts of Mayurbhanj and Cuttack. The policy's primary goal of improving educational equity and social mobility through English proficiency remains admirable but, however, the results show substantial challenges in its implementation, particularly when viewed against the socioeconomic, linguistic, and cultural context of rural Odisha. The gap in the 'policy-practice' discovered in this study reinforces the conflict between the 'top-down' policy vision with the realities of classroom environment, teacher readiness, and student's sociolinguistic settings. The discussion critically interacts with the implications of EMI for rural education in India and considers potential ways-out for more inclusive and contextually appropriate language policies by meticulously integrating the findings and situating them within the larger discourse on the policy of language, bilingualism, and sociolinguistics.

Rationale and Objectives of EMI

An Idealistic Vision or a Practical Reality?

The implementation of EMI in OAVs was envisioned as a strategic step to provide rural students with globalised skills, particularly English fluency, and a knack of English in order to bridge the rural-urban gap and improve access to higher education and provide employment possibilities. The administrators stressed upon the assurance of fairness through linguistic empowerment, glorifying EMI as a tool for upward social mobility, specifically in a worldwide economy where English is regarded as the only route to socioeconomic success. The perspective is consistent with the mainstream discourse on English as linguistic capital (Bourdieu, 1991), in which English proficiency is associated with access to power, economic

opportunity, and social prestige. The findings also depict a grave concern in the underlying assumption of EMI as an equaliser: the programme fails to account for linguistic capital discrepancies between urban and rural children. Most of the students that enter OAVs come from households that are linguistically disadvantaged, with minimal or no exposure to English at home, nor the surroundings. Thus, a comparatively fast change to EMI schooling can eventually result in severe linguistic alienation, an alienation that goes beyond any repairs. Cummins (2000), supporting Bourdieu's (1991) argument that language proficiency is inherently linked to socioeconomic privilege. Whilst the international drive for EMI is consistent with the larger neoliberal ideal of providing children with marketable skills, at the same time, it also tremendously fails to acknowledge the magnanimity of the linguistic reality of rural classrooms. The findings indicate that, while English may be an important worldwide lingua franca, the usage of monolingual approach to language teaching in rural India is impractical and deleterious to student learning. Through the study, we question whether EMI, in its rigid form, is a viable tool for improving educational opportunities, or whether it in a way or the other, unintentionally aggravates the ever-existing linguistic inequality by alienating students from their cultural and linguistic identities, while failing to provide them with the skills required for academic success in a second language.

Teachers' Preparedness!

A Conundrum of Linguistic and Pedagogical Gaps

One of the primary findings of the study concerns teacher's preparedness and ability to effectively implement EMI in the school contexts. The English teachers of both the schools in Cuttack and Mayurbhanj districts of Odisha indicated different levels of comfort while delivering lectures in English, while

the teachers of other subjects, such as Social Science and Science, mentioned problems in translating technical vocabularies and complicated academic content into English. The linguistic and pedagogical problems that instructors experience in their classrooms and inside the schools as an ecosystem, points out to a crucial problem in the implementation of EMI, directing towards insufficient teacher training in both English language instruction and content-based pedagogy. As some of the participants commented about the teachers being frequently trapped between their inadequate English competence and the policy's requirement that English be the exclusive medium of teaching, often resulting into a forcible - without any choice - as a last refuge reliance on code-switching as a coping mechanism to tackle the battles within themselves and their classrooms. The finding is consistent with the literature on EMI, where researchers have time and again in a repeated manner, emphasised upon the lack of professional development for teachers charged with providing content in a second language (Garcia & Lin, 2017). Teacher's linguistic uncertainty, particularly in non-English subjects, has a lasting impact on instruction quality as well as student disengagement and academic underachievement.

The teachers' reliance in the form of dependency on bilingual pedagogies, such as code-switching, and code-mixing denotes a fundamental misalignment between the policy's objectives and its practical implementation inside the classroom. In these settings, code-switching and code-mixing has evolved as an essential approach for scaffolding student comprehension and ensuring student's meaningful engagement with the curriculum. All of it lends support to the hypothesis of translanguaging (Garcia & Lin, 2017), which holds that fluid language practices, rather than strict language separation, usually improves student comprehension and participation in multilingual classrooms. In this regard, the focus on a monolingual EMI

model may be potentially harmful in the absence of proper teacher preparation and linguistic assistance for the students involved. According to the findings, the bilingual approach in which students are instructed in both English and their first language (Odia), was not only an adaptive method but also is considered to be one of the most crucial instruments for effective dissemination of teaching and learning.

Student's Struggles with Comprehension and Engagement

A Plea for Linguistically Responsive Pedagogies

The findings about difficulties faced by the learners with English understanding depicts a harsh assessment of the fundamental assumptions of EMI policies. The students, while were generally excited about the idea of studying English, the usage of English in technical areas like science and social science hampered their understanding of complicated academic content considerably. The gap lying between 'students linguistic potential' and the 'academic expectation of EMI' aggravates their challenges in comprehending subject matter, particularly when abstract or specialist terminology is used. It is consistent with Cummins' (2000) Interdependence Hypothesis, which states about the proficiency in a second language to be closely related to proficiency in the L1, and that a lack of a strong foundation in the L1 impedes the learning of the second language.

The findings also reinforce an important point that the phenomenon of EMI may accidentally lower student's involvement with the subject matter rather than promoting nuanced and layered understanding. According to pupils, the use of English in science classes frequently resulted in decreased interest and involvement, as many of them struggled to understand difficult topics taught in a language in which they were not yet skilled and by the time they were skilled, they were

promoted to next classes with haphazard and incomplete comprehension of the previous classes, resulting into cognitive load which leads to academic failure. It also emphasises the importance of a progressive transition strategy in which students acquire enough linguistic scaffolding in their first language while gradually being introduced to English in a context appropriate manner. Such an approach, based on bilingual education principles, would allow students to preserve academic continuity while gradually strengthening their English skills. The findings showcase an 'all-or-nothing' approach to EMI that is not only unachievable, but also quite harmful to student participation, specifically in rural areas where language capital is unevenly distributed.

Parental Perceptions

The Evolving Intergenerational Linguistic Divide

The parental perception about EMI shows the intergenerational linguistic divide in rural India, where parents, frequently monolingual Odia speakers, are unable to provide the linguistic help their children require when negotiating EMI. Parents showed a significant desire for their children to learn English, understanding its importance in improving employment prospects and social mobility. They were also intensely conscious of their own inability and limitations to support their children's learning because of their limited English skills and stunted academic exposure. Many of the parents were minimally educated and most of them were first generation learners, while only a few among the large proportion did hold the academic significance, as well as academically sound and prestigious work positions. The generational gap between EMI's language expectations and the ground level linguistic realities of rural, semi-urban and urban households creates a hurdle to the policy's successful implementation.

The findings support Cummins (2000) statement that a child's proficiency in their first language is essential for second language learning. Without the assistance of linguistically competent parents, students are left to steer through the difficulties of EMI all on their own, resulting into frequently struggling to keep up with the academic expectations of the curriculum, teachers, parents, society and lastly their own selves. The stakeholders are left to a state of incompetency, insufficiency, being incapable of, and tagged as a failure by the society, inside the school and the immediate members of the family. These students end up in a vicious circle of self-doubt and seek validation in the form of academic assurances, teachers' efforts and family's applauses and accolades to overcome the aftermaths of 'linguistic alienation'. What appears to be beneficial and significant at the beginning, might not translate well in all the circumstances. Such is the case with English medium education in a multilingual country like India and within the multilingually wealthy states like Odisha. If a policy initiative is not executed well in all the levels of stakeholders' involvement, engagement and proper dissemination, it will collapse. Rather than a 'top to down' policy approach, a 'bottom-up' approach often translates well, as it incorporates the views, concerns and experiences of the ground level players.

Classroom Dynamics and Engagement

A Disconnect between Policy and Practice

Classroom observations showcase a diverse approach to EMI in reality, with some teachers aiming to preserve full English immersion and others using code-switching to enhance comprehension. The data indicate that student participation was much higher in classes where teachers employed bilingual methods of teaching

and learning, such as clarifying essential concepts in Odia, than in classes where instruction was followed only in English. This stark difference emphasises upon the disconnect between the EMI mandate and actual classroom reality, where the policy's rigidity impedes student participation and learning. The results indicate that teacher adaptation and the use of multilingual pedagogies are critical for increasing student involvement and comprehension. The findings also question the viability of an English-only approach in a multilingual classroom where students are left to tackle through and steer the challenging academic topics in a second language.

Policy and Curriculum Alignment

Structural Gaps and the Need for Reform

Finally, the document analysis of the policy documents of the state as well as the OAVS pertaining to the execution and imparting of English medium education shows considerable discrepancies between policy goals and actual curricular and pedagogical frameworks in OAVs. The policy document stresses upon EMI's global outreach and worldwide competitiveness, however, there were potential lack of structural support for implementation. The lack of bilingual teacher preparation, along with an English-centric curriculum and insufficient teaching resources, demonstrate a substantial policy-practice gap that must be rectified. The findings also indicate that EMI policies should be more nuanced, with an emphasis on teacher training, curriculum design, and support systems that are capable of accommodating language variety in rural classrooms.

Recommendations

Based on the findings of the study, numerous recommendations arise that are critical and should be given considerable thought for improving the implementation of

English Medium Instruction (EMI) in Odisha Adarsha Vidyalayas (OAVs) and resolving the policy-practice gaps discovered in the educational settings of the research. These recommendations are focussed to address legislative reform, pedagogical techniques, teacher training, curriculum adaptation, and future research directions.

An important recommendation is to implement a phased or transitional EMI strategy rather than an abrupt switch to English as the primary medium of instruction in the schools. Since these schools run from Class VI onwards till Class XII, the change needs to begin from initial classes. The findings show that a progressive bilingual strategy, in which pupils receive early teaching in their native language (Odia) as well as English, will create a stronger linguistic basis for academic achievement. Drawing on Cummins' (2000) Interdependence Hypothesis, which emphasises the transfer of cognitive and linguistic skills across languages, a structured bilingual model would reduce the effects of linguistic alienation while increasing conceptual clarity. This policy move would align EMI with a multilingual education paradigm, acknowledging that children's first-language ability is crucial to second-language acquisition.

A second significant proposal is to take care of the training and capacity building aspect of the teachers. We believe that through a thorough and ongoing teacher training programme, that is specifically designed for EMI deployment, one can meet the untangled ends of these unresolved discrepancies related to the teaching-learning through EMI in schools. The study found that teachers and instructors of non-English topics struggle with material delivery in English, frequently resorting to code-switching to aid student comprehension. While the bilingual practices are advantageous, the teachers who have not had formal training in bilingual or content-based language instruction (CBLI) are unprepared to deal with the linguistic demands of EMI classrooms. So, the teacher training should include a tailored

professional development programme that blends language pedagogy, subject-specific EMI methods, and translanguaging procedures, as this approach would provide teachers with effective instructional tools that promote both content mastery and English proficiency.

Through this study, we also advise revising the EMI curriculum and teaching materials to make them more linguistically acceptable and accessible to the rural students. Currently, the textbooks and instructional materials presuppose a level of English competence that many students lack, making understanding of the subject difficult. To solve this, curriculum designers can create contextually relevant bilingual resources that include glossaries, bilingual summaries, and scaffolding strategies to help students comprehend better inside the classrooms. Furthermore, digital learning tools with interactive bilingual support could be used to supplement classroom instruction, allowing students to reinforce their comprehension at their own speed.

The involvement of parents in EMI education requires deliberate intervention to overcome the generational linguistic gap between parents and students. Many parents from the rural belts lack English proficiency; therefore, they are unable to provide academic support to their children. As a result, community based parental engagement programmes should be designed to provide parents with basic English literacy instruction as well as information on how to support their children's learning at home, as an aid after the school hours. Schools might also organise parent-teacher simulation workshops to educate parents on how to help their children in EMI settings, establishing a more supportive learning atmosphere.

Another recommendation is to implement language support mechanisms in schools to assist children who are suffering with EMI. According to the study, language obstacles often cause students to disengage from lessons, which has a negative influence on their academic achievement. To address this

issue, schools should implement structured English language support programmes, such as bridge courses, remedial language classes, and peer assisted learning initiatives. These interventions would ensure that children acquire the linguistic abilities required to traverse an EMI curriculum without experiencing cognitive overload or academic marginalisation.

Policymakers and the administrators of OAVs should consider greater flexibility in EMI implementation rather than a strict English-only mandate. They should consider using a varied EMI approach in which the extent of English immersion varies according to students' language backgrounds and regional differences. Additionally, policy reviews should be undertaken on a regular basis, using empirical classroom data and student performance measures to assess the effectiveness of EMI in enhancing learning outcomes. If EMI is proven to impede comprehension rather than improve educational quality, policies should be revised to better integrate bilingual or multilingual approaches.

Finally, the study punctuates upon the need for additional research on EMI in rural India, on longitudinal student outcomes, cognitive load effects, and socio-cultural components of English learning. The study provides a layered and ground level evaluation of EMI in OAVs, while the future research should take steps forward and look into EMI students' long term academic routeways and compare their performance to counterparts in non-EMI contexts. Furthermore, studying teacher identity and language ideologies in EMI classrooms would provide vital insider's perspective into how pedagogical practices change in response to linguistic obstacles.

Though the research already expanded its research scope and have included the comparative element by bringing forth the comparison of rural and urban EMI in OAVs, however, taking a greater number of schools from different blocks of the state would incorporate diversity, provide different perspectives and will also result

in more nuanced understanding of the various ways in which EMI works in different socioeconomic and linguistic settings.

The EMI, while considered as a potential policy endeavour, also requires potential changes to harmonise with the linguistic reality of rural, semi-urban and urban Odisha. Implementing multilingual transitional models, boosting teacher training, modifying curricula, increasing family involvement, and implementing organised language support systems are critical steps toward ensuring that EMI promotes educational fairness rather than exclusion. With educated policy changes and continued research, EMI can be converted into a more inclusive, context-sensitive, and pedagogically sound framework that truly serves the rural talents of Odisha.

Conclusion

According to the findings, the study places importance of a context sensitive, multilingual instructional framework for EMI in OAVs. The study concludes that when applied strictly, EMI runs the risk of aggravating linguistic alienation and academic disengagement rather than facilitating inclusive educational opportunities. To address these challenges, the study strongly supports for a more flexible approach to language instruction, one that integrates bilingual pedagogies, believes in gradual language transitions, and a composite teacher training in multilingual contexts. Only then, through a holistic, research informed approach, EMI can fulfil its potential to serve as a tool for educational equity in rural Odisha.

Appendix

Data Collection Tool

Tool	Objective	Key Questions/Observations
Semi-Structured Interview Guide for Policymakers and Education Administrators	Explore rationale, objectives, and challenges of EMI policies in OAVs.	1. What were the primary objectives behind the introduction of EMI in OAVs? 2. How do you assess the impact of EMI on educational quality and access for marginalised students? 3. What challenges have emerged in the implementation of EMI in rural areas? 4. How do you envision the future of EMI in OAVs and its broader implications for public education in Odisha?
Semi-Structured Interview Guide for Teachers	Investigate teachers' perceptions and experiences with EMI implementation.	1. How confident are you in delivering lessons in English under the EMI framework? 2. What challenges do you encounter when teaching students with limited English proficiency? 3. How frequently do you use bilingual strategies, such as code-switching and code-mixing, in your classroom? 4. How do students respond to EMI-based instruction, and what strategies do you employ to support them?
Focus Group Discussion Guide for Students	Understand students' experiences and challenges with EMI.	1. How do you feel about learning in English compared to your native language? 2. Do you face difficulties understanding lessons taught in English? How do you address these challenges? 3. In which subjects or areas do you feel EMI has the most significant impact on your learning? 4. Do you believe learning in English will benefit your future opportunities? Why or why not?

Focus Group Discussion Guide for Parents	Explore parents' perceptions of EMI and its effects on children's academic performance.	1. What is your opinion on the use of EMI in your child's education? 2. Do you feel that your child struggles with content taught in English? If so, in what way? 3. How do you view the potential of bilingual or multilingual strategies to enhance your child's learning experience? 4. How do you think EMI affects your child's future opportunities?
Classroom Observation Checklist	Assess EMI implementation in classrooms focusing on teaching practices and student engagement.	Teacher's Language Use 1. Does the teacher primarily use English or switch to the local language? 2. How often is code-switching used? Student Engagement 1. Are students engaged in English-language interactions? 2. Do they understand the content? • Pedagogical Approaches: Are bilingual or multilingual strategies employed? Student Challenges Are students showing difficulty with EMI (e.g., confusion, disengagement)?
Document Analysis Template	Evaluate the alignment of policy, curriculum, and teaching practices with EMI.	Policy Documents • What are the key goals of EMI in OAVs? • Is there an emphasis on bilingual teaching approaches? Curriculum and Teaching Materials • Are the materials designed to accommodate limited English proficiency? Teacher Training Does the policy mention training teachers in EMI or multilingual pedagogies?
Ethical Considerations	Ensure ethical integrity and transparency in data collection.	Informed Consent Participants will be informed about the purpose, voluntary nature, and confidentiality of the study. Confidentiality Agreement Data will be anonymised and securely stored.

Researcher's Positionality: The above 'Appendix' is a broad outline of the tool used for data collection. The questions were administered multilingually by incorporating Odia, Hindi and English languages based on the convenience, comprehensibility, and comfort of the stakeholders involved in the research. At the first place, such an approach was essentially used to mitigate the issues of unfamiliarity and to value stakeholder's knowledge, time and space. By ensuring all of these, it helped us gain access to unfiltered ground level realities.

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गणित में समस्याओं से जूझने का आनंद

मुकेश मालवीय

बच्चों के साथ गणित शिक्षण प्रक्रिया में क्या टीचर भी आनंद ले सकते हैं? पाठ्यपुस्तकों में लिखी बातें, अवधारणाएं, चुनौतियाँ बच्चों के लिए तो नई होती हैं, पर टीचर के लिए यह सब कुछ पुराना देखा समझा हुआ ही होता है। स्कूली गणित की कोई अवधारणा या चुनौती टीचर के लिए जिज्ञासा या नयेपन से नहीं खुलती क्योंकि साल दर साल वे इसे उसी तरह से देखते आये हैं। कुछ टीचर के साथ कभी यह हो कि उनके मन में किसी अवधारणा की समझ के प्रति शंका पैदा हो और वे बच्चों को समझाने के लिये नहीं बल्कि अपने लिए उस अवधारणा को फिर से समझने कि कोशिश करें जैसे - क्षेत्रफल के सवाल को समझाते हुए उनके मन में आये कि लम्बाई में चौड़ाई का गुणा करने पर क्षेत्रफल कैसे निकल आता है? या भिन्न को समझाने के लिए किसी इकाई के बराबर हिस्से करना क्यों जरूरी है? या कोई सूत्र या नियम क्या है? इसके बजाय नियम वैसा ही क्यों है? जब टीचर खुद के लिए गणित को समझते हैं तब ही उनके पास इन गणितीय अवधारणाओं के अलग तरह से अपने नए अर्थ बनते हैं। इन नए अर्थों को टीचर अपने शब्दों में पिरोकर बच्चों के साथ संवाद की एक नई भाषा बना सकते हैं जो पाठ्यपुस्तक की भाषा से अलग होती है। सीखने सिखाने का यह अर्थपूर्ण संवाद और अनुक्रिया गणितीय अवधारणा को समझने, गणितीय चुनौतियों को हल करने, अपने तर्क इस्तेमाल करने, गणितीय समस्या से जूझने, उपलब्धि सफलता या उत्तर हासिल करने में बच्चों और टीचर को एक जैसे आनन्द का भाव उत्पन्न करता है।

बच्चों के सामने गणित अगर उन्हें समझ में आने वाले सवाल या समस्या या किसी चुनौती के रूप में आता है तो वे उसे हल

करने की तरफ अग्रसर होते हैं या उसका उत्तर हासिल करने के लिए अपनी खुद की समझ का इस्तेमाल करते हुए उससे जूझते हैं।

मेरी गणित की कक्षा में भी ऐसा ही कुछ हुआ। हम कक्षा 6 में संख्याओं पर संक्रियाओं की बात कर रहे थे। पाठ्यपुस्तक में योग के गुणधर्म बताये गए हैं। इन गुणधर्मों को जो कि क्रम विनिमय, साहचर्य, तत्समक आदि है इन्हे समझाना था। जोड़ घटाना गुणा भाग के सवाल इन बच्चों को हल करना खूब आता था पर इस अध्याय में तो नियमों को समझना था। मैंने सोचा इन नियमों को अपनाने या मान लेने से पहले कुछ सरल नियम बच्चों को खुद बनाना आना चाहिए। क्या वे कुछ उदाहरणों के आधार पर सामान्यीकरण कर, कोई दावा या कथन बना सकते हैं? इसके लिए मैंने उनसे चर्चा शुरू की। मुझे यह सूझा कि यह बात करें कि क्या हम किसी संख्या को दो संख्या के जोड़ के रूप में देख सकते हैं। तो, मैंने बच्चों के बीच सवाल उठाया कि क्या किसी संख्या को दो अन्य संख्याओं के जोड़ के रूप में बताया जा सकता है?

मैं बोर्ड पर एक संख्या लिख रहा हूँ आप इसे दो संख्याओं के जोड़ की तरह बताओ। मैंने एक छोटी संख्या लिखी 10। बच्चों को यह समझने में थोड़ी देर लगी कि मैं उनसे क्या सवाल पूछ रहा हूँ? समझाने के लिए मैंने कुछ उदाहरणों का सहारा लिया। जैसे 10 को हम $8+2=10$ या $6+4=10$ लिख सकते हैं, इसी तरह और कौन कौनसी दो और संख्याओं के जोड़ से 10 बनता है, बच्चों को बात समझ में आई और उन्होंने बताना शुरू किया। मैंने उनके बताये हुए समूहों को बोर्ड पर लिखा और उन्हें प्रोत्साहित किया कि वे सभी संभव युग्मों को सोच

पाएं, कुछ देर तो वे बिना क्रम के कोई भी दो संख्या बोल रहे थे जैसे 7+3 या 2+8। फिर उन्होंने सहज ही एक क्रम खोज लिया

10= (6+4), (7+3), (8+2), (9+1), (5+5), (4+6), (3+7), (2+8), (1+9)

7= (6+1), (5+2), (4+3), (3+4), (2+5), (1+6)

8= (7+1), (6+2), (5+3), (3+5), (2+6), (1+7)

9=(8+1), (7+2), (6+3), (5+4), (4+5), (3+6), (2+7), (1+8)

हरेक संख्या के लिए बने इन युग्मों/ जोड़ों की कुल संख्या कितनी है? यह हमने गिनकर देखा संख्या 10 के लिए 9 जोड़े बने हैं, संख्या 7 के लिए 6, एवं 8 के 7 तथा 9 के 8 जोड़े बने हैं, अब मैंने यह सवाल रखा कि अगर संख्या 15 है तो उसके लिए कितने जोड़े बनेंगे, कुछ बच्चे फिर से जोड़े बनाने लग गए पर एक दो ने जल्दी ही जबाब दिया कि 15 के लिए 14 जोड़े बनेंगे। बाकी बच्चे भी उनकी बात से सहमत हो गए। अब तक के काम और चर्चा के आधार पर हमने यह दावा/ कथन बनाया -

1. एक को छोड़कर प्रत्येक संख्या दो संख्याओं के जोड़ के रूप में बताई जा सकती है, (अभी हम 0 का जोड़ नहीं कर रहे हैं)
2. किसी संख्या के बराबर दो संख्या के युग्म या जोड़ की कुल संख्या उस संख्या से एक कम होगी।

क्या यह दोनों कथन सही हैं, ज्यादातर बच्चों का यह मानना था कि यह सही है पर एक बालिका ने कहा- संख्या 10 के जोड़ों में 6+4 और 4+6 में तो एक ही तरह की दो संख्याएं हैं इसी तरह 7+3 और 3+7 में भी एक ही तरह की संख्याएं हैं। हम सभी उसकी बात से सहमत हुए। अब हमने इस तरह समान संख्याओं से बनने वाले जोड़े हटा दिए और बने हुए कुल युग्मों की संख्या गिनी साथ ही कुछ और संख्याओं के लिए जोड़ के युग्म बनाए।

7= (6+1), (5+2), (4+3)। तीन

8= (7+1), (6+2), (5+3), (4+4) चार

9=(8+1), (7+2), (6+3), (5+4) चार

10= (9+1), (8+2), (7+3), (6+4), (5+5) पांच

11=(10+1) (9+2) (8+3) (7+4) (6+5) पांच

12=(11+1) (10+2) (9+3) (8+4) (7+5) (6+6) छह

13= (12+1) (11+2) (10+3) (9+4) (8+5) (7+6) छह:

बोर्ड पर लिखी संख्याओं और उनके लिए बने जोड़ के युग्मों को देखकर हम क्या कोई कथन बना सकते हैं? बच्चें सोचकर अलग अलग कथन बोलते रहे। इन सब में संख्या से उसके जोड़े आधे के करीब होने का अभिप्राय था। भाषा ठीक से बन नहीं रही थी पर उन्हें समझ आ रहा था।

चूंकि मैं भी संख्याओं को पहली बार इस तरह से देख रहा था तो मुझे ज्यादा उतावलापन था। मैंने तुरत ही अगला सवाल रखा कि- क्या किसी संख्या को दो संख्याओं के अंतर या घटाव के रूप में बताया जा सकता है?

10 को दो संख्या के घटाव की तरह बताओ?

हमने देखा -

10= 11-1, 12-2 13-3 14-4 15-5 16-6 आदि-आदि इस तरह तो हम कितने ही आगे जा सकते हैं

15= 16-1, 17-2, 18-3, 19-4, -----

5= 6-1, 7-2, 8-3, 9- 4, 10-5, 11-6, इस तरह आगे बढ़ते ही जाएंगे

अब इसके लिए दावा या कथन बनाने की बारी थी, यह कथन हम सब ने मिलकर बनाया।

किसी भी संख्या को दो संख्याओं के घटाव से बताया जा सकता है और हर संख्या के लिए घटाव के बहुत सारे युग्म हो सकते हैं कक्षा मै मौजूद सभी बच्चे इस कथन पर सहमत थे जब जोड़ और घटाव से किसी संख्या को व्यक्त किया जा सकता है

तो स्वाभाविक रूप से अगला प्रश्न हमारे दिमाग में यह आया कि- क्या किसी संख्या को दो संख्याओं के गुणनफल के रूप में व्यक्त किया जा सकता है?

1 को नहीं

2 को $2*1$

3 को $3*1$

4 को $4*1$ और $2*2$

यहीं हमने यह बात की कि 1 से गुणा करने पर तो वही संख्या प्राप्त होती है और प्रत्येक संख्या को उसी संख्या के एक और गुणनफल के रूप में बताया जा सकता है, इसलिए 1 के गुणन को हम नहीं मानेंगे। अब हमने फिर से और संख्याएं लिखीं और एक एक संख्या पर बात करते गए।

1 को नहीं 11 नहीं

2 को नहीं $12 = 2*6, 4*3$

3 को नहीं 13 नहीं

$4 = 2*2$ $14 = 2*7$

5 को नहीं $15 = 5*3$

$6 = 2*3$ $16 = 2*$

7 नहीं $17 = \text{नहीं}$

$8 = 4*2$ $18 = 9*$

$9 = 3*3$ 19 नहीं

$10 = 5*2$ $20 = 10*2, 5*4$

अब हमने सोचा कि क्या अब तक हम कोई दावे लायक पैटर्न देख पा रहे हैं ?

बच्चों ने कहा - कुछ संख्याओं को हम दो संख्याओं के गुणन से लिख सकते हैं और कुछ को नहीं।

अगला काम हमने तय किया कि हम देखने की कोशिश करते हैं कि कौन-कौन सी संख्याओं को हम दो संख्याओं के गुणन

के रूप में नहीं लिख सकते? सुविधा के लिए मैंने संख्याओं को नीचे की तालिका जैसे लिख दिया।

1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	20
21	22
23	24
25	26
27	28
29	30
31	32
33	34
35	36
37	38 क्रमशः

इस तरह की जमावट से सोचने में आसानी हो गई। एक बच्चे का ध्यान इस पर गया कि दूसरी पंक्ति की ये सब संख्याएं 2 के पहाड़े में आती हैं। मैंने इसमें जोड़ा की पहाड़े का मतलब तो गुणा ही है जैसे $2*5 = 10$ या $2*32 = 64$ । इसका मतलब यह कि इस पंक्ति की संख्याओं को दो संख्याओं के गुणन के रूप में लिख सकते हैं। हमने 100 में से 50 संख्याएं ऐसी पा ली जो दो के गुणज की तरह लिखी जा सकती थीं। इनमें से 2 हमारे $2*1$ के नियम में आती थी इसे छोड़ने पर हमें 49 संख्या मिल गई जिन्हें हम 2 के गुण के रूप में लिख सकते थे।

अब हमें पहली पंक्ति को ध्यान से देखना था। मैंने बच्चों से पूछा कि क्या हम इस पंक्ति की इन सभी संख्याओं को दो संख्याओं के गुणन के रूप में नहीं लिख सकते? हम 9 और 15 को तो पहले ही 3 के गुणन के साथ लिख चुके थे। हमने तय किया कि इस पंक्ति में कुछ संख्याएं हैं जो 3 के पहाड़े में

आती हैं। इन्हें और इन जैसी और को कैसे अलग किया जाए? क्या इस पंक्ति को कुछ अलग तरह से जमाया जा सकता है ? कुछ देर सोचने और दो तीन तरह से जमावट करने के बाद हमें एक तरीका मिल गया। हमने इस पूरी पंक्ति को क्रमशः 3 लाइनों में डाल दिया

1	3	5
7	9	11
13	1 5	17
19	2 1	23
25	2 7	29
31	3 3	35
37	3 9	41
43	4 5	47
49	5 1	53
55	5 7	59
61	6 3	65
67	6 9	71
73	7 5	77
79	8 1	83
85	8 7	89
91	9 3	95
97	9 9	

अब बीच की पंक्ति की संख्याओं को हम 3 के पहाड़े की तरह देख सकते थे जो कि 3 के गुणज के रूप में थी। हमने 3 के नीचे की इन 16 संख्याओं को गुणन संख्याओं के रूप में माना। इस तरह हमें 16 संख्याएँ और मिल गई अब तक $49+16=65$

संख्याएँ हो गई थीं जिन्हें हम दो संख्या के गुणन के रूप में लिख सकते थे। अब हमने बीच के पंक्ति को हटा दिया, और पहली पंक्ति को जब हम ध्यान से देख रहे थे तभी हमें संख्या 25 दिखी जो कि 5 की गुणज थी। 5 की गुणज वाली और भी संख्याएँ हम देख पा रहे थे। अभी तक हमें पंक्तियों में जमावट के आधार पर संख्याओं को गुणन के रूप में देखने का एक पैटर्न मिला था और हम उसे और आगे बढ़ाना चाहते थे। हमने अब सोचा कि इन्हें कैसे जमाएं कि ये सब एक लाइन में आ जाएं। हमारे पास दो पंक्तियाँ थीं। थोड़ी माथा पच्ची के बाद हमें एक तरीका मिल गया।

हमने पहली पंक्ति की 5 संख्याएँ आड़ी जमाईं। उसके नीचे 5 के नीचे आने वाली पंक्ति की 5 संख्याओं को आड़ा जमाया (पहली 5 छोड़कर) इस तरह की जमावट से हमें एक नया पैटर्न मिला। इस जमावट से एक ही इकाई वाली संख्याएँ एक पंक्ति में आ गईं, और इस तरह 5 के गुणज भी एक पंक्ति में आ गए।

1	7	13	19	25
11	17	23	29	35
31	37	43	49	55
41	47	53	59	65
61	67	73	79	85
71	77	83	89	95
91	97			

इस तरह हमारे पास अब अंतिम पंक्ति में 5 के गुणज थे। इन 6 संख्याओं को हम हटा सकते थे। अब तक हमने $(65+6=71)$ संख्याओं को हटा दिया था।

सब बच्चे और मैं खूब रोमांचित थे। हमें मज़ा आ रहा था, थोड़ा रुककर अभी तक हमने क्या किया इस पर हमने चर्चा की।

हम किसी संख्या को दो संख्याओं के गुणज के रूप में व्यक्त करना चाहते थे:

1 की गुणज तो सभी संख्याएँ है

2 की गुणज वाली संख्याएँ हमने पहली जमावट से अलग करीं

3 की गुणज वाली बाकी संख्याएँ भी दूसरी जमावट में अलग हुईं.

4 की गुणज वाली संख्याओं के बारे में बच्चों से बात की और यह सहमती बनी कि जो संख्या 4 की गुणज होगी वह दो की भी गुणज होगी जैसे $3 \times 4 = 12$ वही है जो $6 \times 2 = 12$ इस तरह 4 की गुणज वाली संख्याएँ भी पहली जमावट में हट गई हैं

5 की गुणज की संख्याएँ तीसरी बार की जमावट में अलग हो गईं।

6 की गुणज की संख्याएँ 2 और 3 के गुणज में भी आएँगी जैसे $3 \times 6 = 18$, 18 को हम 2 के गुणज 9×2 और 3 के गुणज 6×3 की तरह भी लिख सकते हैं, इस तरह 6 के गुणज वाली संख्याएँ भी हट चुकी हैं।

अब 7 के गुणज की बारी थी, हमने चर्चा से समझा कि 7 के दूसरे तीसरे चौथे पाँचवें और छठवें गुणज तो इस तरह की जमावट में हट ही गये हैं।

अब 7 का सातवाँ गुणज $7 \times 7 = 49$

7 का 11 वाँ गुणज $7 \times 11 = 77$

7 का 13वाँ गुणज $7 \times 13 = 91$ बचा है

इन तीन संख्याओं को हटाने का जमावट वाला कोई तरीका नहीं मिल रहा था। पर इन 3 संख्याओं को भी हमने अपनी सूची में शामिल कर लिया ($71 + 3 = 74$)। अब 100 तक की संख्याओं में से हमारे पास कुल 26 ऐसी संख्याएँ थीं, जिन्हें हम दो संख्याओं के गुणज के रूप में नहीं बता सकते थे, यह हमारे लिए बड़ी सफलता थी कि 1 से 100 तक में से केवल 26 संख्याएँ बची हुई थीं जिन को हम दो संख्याओं के गुणन से नहीं पा सकते थे।

यहाँ जब हम 7 के गुणज को खोज रहे थे तब हमें एक दिलचस्प बात समझ आई, हमें एक नया सूत्र मिल गया। हम 7 का गुणा उन्हीं संख्याओं से कर रहे थे जो हमारी इन पंक्तियों में बची हुई थीं। हमने इस बात पर विचार किया इन शेष संख्याओं के आपसी गुणन से प्राप्त गुणनफल वाली संख्याओं को अगर हम

हटा दें तो हमारे पास केवल वही संख्याएँ बचेंगी जो किन्हीं भी दो संख्याओं का गुणनफल नहीं हैं। इस समझ पर सहमति बनते ही हम उत्साह से भर गए। हमारे पास एक नया सुप्रीम दावा था।

इन चार पंक्तियों की जमावट में जो संख्याएँ हैं उनमें से हरेक संख्या का आपस में गुणा करने पर जो संख्याएँ आयेंगी, उन सारी संख्याओं को अगर हम हटा दें तो हमें वे संख्याएँ मिल सकती हैं जिन्हें दो संख्याओं के गुणनफल के रूप में नहीं बताया जा सकता।

यह काम इतना जुनूनी हो गया था कि मैं और बच्चे इसे छोड़ना नहीं चाहते थे।

100 तक तो हमने इस तरह की संख्याओं का पता लगा लिया था अब हमने दायरा बढ़ा कर 1000 तक कर लिया।

7	11	13	19
17	31	23	29
37	41	43	49
47	61	53	59
67	71	73	79
77	91	83	89
97	101	103	109
107	121	113	119
127	131	133	139
137	151	143	149
157	161	163	169
167	181	173	179
187	191	193	199
197	211	203	क्रमशः

हमने पहले एक पंक्ति को लिया जिसमें 7 की इकाई वाली संख्याएँ थीं। मैंने बच्चों से पूछकर यह तय किया कि 7 की इकाई वाली संख्याओं में 1 इकाई वाली संख्याओं का गुणा करते हैं जैसे $7 \times 11 = 77$ । ऐसा करने पर हमें 7 की इकाई वाली संख्याएँ ही मिलीं। इस तरह हम इन दोनों पंक्तियों का आपस में गुण करते गए यह काम तब तक ही किया जब तक कि प्राप्त गुणनफल 1000 के अन्दर रहे। क्या और किसी पंक्ति के आपसी गुणन से 7 की इकाई वाली संख्याएँ मिल सकती हैं?

एक बच्चे ने बताया की 13 वाली पंक्ति और 19 वाली पंक्ति का गुणा करने पर भी 7 की इकाई वाली संख्याएं मिलेंगी। इस बात से हम सब सहमत थे। हमने बच्चों के समूह बनाए और मिशन गुणनफल की शुरुआत की।

7*11=77	19*13=247
17*11=187	29*13=377
37*11=407	49*13=637
47*11=517	59*13=767
67*11=737	--
77*11=847	19*23=437
--	29*23=667
7*31=217	--
17*31=527	19*43=817
7*41=287	--
17*41=697	--
7*61=427	--
7*71=497	--
7*101=707	--
7*131=917	--

ये सभी संख्याएं दो संख्याओं के गुणज से प्राप्त हो रही थीं, जिन्हें हमने 7 वाली पंक्ति में मार्क कर दिया। अब 11 वाली पंक्ति की बारी थी। बच्चों ने तय करके बताया कि 11 वाली पंक्ति में इसी पंक्ति की संख्याओं का आपस में गुणा करने पर 1 इकाई वाली संख्या ही आएगी जैसे 11*11=121, 31*11=341। मैंने बच्चों को बताया कि 7 इकाई वाली पंक्ति में 3 इकाई वाली पंक्ति का गुणा करने पर भी 1 की इकाई वाली संख्याएं ही मिलेंगी। और 9 की इकाई वाली में 9 की इकाई वाली पंक्ति का गुणा करने पर भी 1 इकाई वाली संख्याएं मिलेंगी। अब हमारी टीम फिर जुट गई और उन्होंने यह गुणज भी निकाल दिए।

13*7=91	11*11=121	19*19=361
23*7=161	11*31=341	19*29=551
43*7=301	11*41=451	29*29=841
53*7=371	11*61=671	49*19=931
73*7=511	11*71=781	--
83*7=581	--	--

103*7=721	31*31=961	--
113*7=791	--	--
133*7=931	--	--
13*17=221	--	--
23*17=391	--	--
43*17=731	--	--
53*17=901	--	--
13*37=481	--	--
23*37=851	--	--
13*47=611	--	--
13*67=871	--	--

जो ये संख्याएं मिलीं उन्हें इस एक इकाई वाली पंक्ति में मार्क कर लिया गया। अभी हम थके नहीं थे हमें 3 इकाई वाली और 9 इकाई वाली संख्याओं की छंटनी करनी थी।

विमर्श से तय हुआ की 13 वाली पंक्ति में 11 वाली पंक्ति और 19 वाली पंक्ति में 7 वाली पंक्ति का गुणा करें तो हमें 3 इकाई वाली संख्याएं मिलेंगी। हमारे मिशन गुणनफल से ये संख्याएं निकल कर आईं।

11*13=143	7*19=133
11*23=253	7*29=203
11*43=473	7*49=343
11*53=583	7*59=413
11*73=803	7*79=553
11*83=913	7*89=623
31*13=403	7*109=763
31*23=713	7*119=833
41*13=533	7*139=973
41*23=943	17*19=323
61*13=793	17*29=493
71*13=923	17*49=833
--	37*19=703
--	47*19=893

इन संख्याओं को चिह्नित करने के बाद इन 1000 तक की संख्याओं में अब केवल 9 इकाई वाली पंक्ति में ही ऐसी संख्याएं बची थीं जो दो संख्याओं के गुणनफल से आ सकती

थीं। इनके लिए क्यों रुकना, $13*13$ और $19*11$ और $7*7$ करने पर ऐसी संख्याएं आएंगी जिनकी इकाई में 9 है तो इन पंक्तियों के लिए मिशन गुणनफल फिर शुरू हो गया।

$7*7=49$	$17*17=289$	$13*13=169$
$17*7=119$	$37*17=629$	$13*23=299$
$37*7=259$	$47*17=799$	$13*43=559$
$47*7=329$	--	$13*53=689$
$67*7=469$	$11*19=209$	$13*73=949$
$77*7=539$	$11*29=319$	$23*23=529$
$97*7=679$	$11*49=539$	$23*43=989$
$107*7=749$	$11*59=649$	--
$127*7=889$	$11*79=869$	--
$137*7=959$	$11*89=979$	--
--	$31*19=589$	--

11	13	17	19
	23		29
31		37	
41	43	47	
	53		59
61		67	
71	73		79
	83		89
		97	
101	103	107	109
	113		
		127	
131		137	139
			149
151		157	
	163	167	
	173		179
181			
191	193	197	199
211	223	227	229
	233		239
241			
251		257	
	263		269
271		277	

--	$31*29=899$	--
--	$41*19=779$	--

इन संख्याओं को मार्क करने के बाद अब हमारे पास 1000 तक की केवल वही संख्याएं बची थीं जो कि किसी तरह भी दो अलग संख्याओं के गुणनफल से प्राप्त नहीं हो सकती थीं। यह हमारे लिए बड़ी उपलब्धि थी। पर हमारा खेल दावा बनाने के लिए शुरू हुआ था। जमावट का यह चार्ट बनाकर हमने अपनी कक्षा की दीवार पर लगा दिया। क्या इन संख्याओं को हम अभाज्य संख्या भी कह सकते हैं? इस पर थोड़ी बातचीत हुई और सहमति बनी। इसे देखकर हमने कितने ही नए दावे या प्रश्न बनाए जैसे:

281	283		
	293		
		307	
311	313	317	
331		337	

--	--	347	349
--	353	--	359
--	--	367	--
--	373	--	379
--	383	--	389
--	--	397	--
401	--	--	409
	--	--	419
421	--	--	--
431	433	--	439
--	443	--	449
--	--	457	--
461	463	467	--
--	--	--	479
--	--	487	--
491	--	--	499
--	503	--	509
--	--	--	--
521	523	--	--

--	--	--	--
541	--	547	--
--	--	557	--
--	563	--	569
571	--	577	--
--	--	587	--
--	593	--	599
601	--	607	--
--	613	617	619
--	--	--	--
631	--	--	--
641	643	647	--
--	653	--	659
661	--	--	--
--	673	677	--
--	683	--	--
691	--	--	--
701	--	--	709
--	--	--	719
--	--	727	--
--	733	--	739
--	743	--	--
751	--	757	--
761	--	--	769
--	773	--	--
--	--	787	--
--	--	797	--
--	--	--	809
811	--	--	--
821	823	827	829
--	--	--	839
--	--	--	--
--	853	857	859
--	863	877	--
881	883	887	--
--	--	--	--
--	--	907	--
911	--	--	919
--	--	--	929
--	--	937	--
941	--	947	--

--	953	--	--
--	--	967	--
971	--	977	--
--	983	--	--
991	--	997	--
--	--	--	--

1. लगातार आने वाली वे 19 संख्याएं कौनसी हैं, जिन्हें 2 संख्याओं के गुणन से प्राप्त किया जा सकता है?
2. 10 से 1000 के बीच इकाई के स्थान पर 1 वाली केवल 30 संख्याएं ही हैं जो कि अभाज्य हैं, क्या यह दावा सही है?
3. क्या हर 100 संख्याओं के बीच आने वाली अभाज्य संख्याओं की संख्या बराबर है?

इस जमावट को और तालिका को देखकर आप भी कुछ नए दावे या प्रश्न बना सकते हैं जो आपने पहले कभी नहीं सोचें हो या आपको पहली बार इस तालिका को देखकर सूझ रहे हों?

इसे लेख को पढ़कर कोई यह कह सकता है कि यह सब तो सुन्दरम या अरोस्थेनिक ने पहले ही बता दिया है। इसमें नया क्या है? इसके जबाब में मैं यह कहूँगा कि इस कक्षा के लिए यह हमारा मौलिक काम था जो बच्चों के साथ मिलकर शिक्षक के रूप में मैंने किया था। यह संख्याएं जमावट के जरिये हासिल हुई थीं। इकाइयों के आधार पर बनी नई जमावट एक नया और सुंदर पैटर्न थीं।

यह बात अक्सर कही जाती है कि बच्चों को सीखने में तभी मजा आएगा जब शिक्षक को भी आनंद आए। और यह तभी होगा जब शिक्षक और बच्चे दोनों मिल कर कुछ चुनौती में पड़ेंगे या कुछ खोजेंगे। और जो खोजा जाएगा वह बच्चों के साथ शिक्षक के लिए भी नया होगा। इस पैटर्न को हासिल करने में बच्चे और मैं बराबरी से जूझ रहे थे और हमें इस उपलब्धि तक पहुंच कर मजझा भी बराबर का ही आया।

एन सी एफ 2023 में भी खुले प्रश्नों व कम्प्यूटेशनल थिंकिंग की बात कही है। 2005 के एन सी एफ ने गणितीयरण और संख्याओं व अन्य गणितीय आब्जैक्ट से नयी-नयी खोजबीन करने अपने सवाल बनाने व नये पैटर्न ढूंढने की बात की थी,

इसके साथ-साथ आजकल कई शोध सीखने-सिखाने में शैक्षिक जोखिम के महत्व की बात करते हैं। याने सीखने के ऐसे टास्क और ऐसे सवाल जिनके हल आपके पास पहले से मौजूद नहीं हैं। एकेडमिक रिस्क टेकिंग (Sara Abercrombie, Kira J. Carbonneau, Carolyn J. Hushman, 2022) में बताया गया है इस तरह की शैक्षणिक गतिविधियाँ जिनमें पहले से तय उत्तर नहीं होते उनका सामना करना, उनसे जूझना होता है। इसमें असफलता का खतरा तो होता है लेकिन यह मौलिक तरीके से सीखने में अहम भूमिका निभाते हैं। इसमें प्रश्न को समझने के लिए प्रश्न पूछना, अपने विचारों को साझा करना या चुनौतिपूर्ण समस्याओं को हल करने का प्रयास करना शामिल है। मेरी कक्षा में संख्याओं के साथ खोजबीन की यह गतिविधि शायद इसी तरह का

एक उदाहरण है। इस तरह के खुलेपन के कई और रूप हो सकते हैं।

मैं अपने शिक्षण के प्रारंभिक दौर में एक रचनात्मक प्रशिक्षण का हिस्सा बना था। इस अलग तरह के प्रशिक्षण ने मेरी शिक्षण प्रक्रियाओं में एक प्रायोगिक नवाचारी और रिस्क टेकिंग दृष्टिकोण अपनाने का आधार दिया। यह स्कूली शिक्षा में काम करने वाली एक स्वैच्छिक संस्था एकलव्य का प्राथमिक शिक्षा कार्यक्रम (प्राशिका) था जो कुछ वर्षों तक मेरे स्कूल के बच्चों और मेरे साथ रहा। इसमें हम शिक्षकों ने बच्चों के सीखने की प्रक्रियाओं को और स्कूली शिक्षा के विषयों को एक तरह से शोध और खोज कि तरह विकसित और आत्मसात किया था, इसलिए संख्याओं की यह जमावट मुझे मेरी कक्षा के बच्चों की खोज और उपलब्धि का अहसास देती है।

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Effects of Prolonged Sitting in Schools on Musculoskeletal Health of School Children in Delhi

Meghna*, Pratima Singh** and Renu Arora***

Abstract

Prolonged hours of sitting, including static posture, in school during school hours puts extreme physical stress on the muscles and ligaments. Since school children are expected to be in the classrooms for a long duration of four to six hours in a day and do most of the activities seated, it is imperative to observe and analyse the sitting posture musculoskeletal discomfort faced by children during the course of the school day. Also, to find out the incidence of musculoskeletal discomfort among them, the author chose to study a total of 450 students from five public schools of New Delhi. The results revealed that a significant percentage of school children experienced frequent body pain caused by forward bending postures and other awkward postures maintained during long hours of classroom activities. The result of these inappropriate sitting postures can sometimes lead to alteration in the shape of the body, muscle cramps, discomfort in the back and legs. These musculoskeletal problems highlight the need of further research to encourage appropriate sitting postures among school children.

Keywords: Static postures, musculoskeletal discomfort, prolonged sitting, forward bending posture, classroom activities.

Introduction

School children devote a significant amount of their daytime in the classroom (four to six hours each day) carrying out different activities like sketching, colouring, reading, writing, and other related activities (Savanur et al., 2004).

The built environment in school should allow for ample space for each child to comfortably sit while performing classroom tasks. Not only this, the classrooms should also accommodate needs and requirements of different students by providing enough space in classroom or by providing adjustable furniture or by providing variety of furniture in terms of size of seat, depth of seat, under desk leg space, etc. (Pellegrini, 1995). Research studies have suggested that the built and

communal aspects of the environment in schools need to be connected and should not be dissected. Further, research studies have shown that the children are compliant to diverse surroundings, either by swapping their conduct (Ozdemir & Yilmaz, 2008) or by altering the surrounding (Catling, 2005; Kytta, Kaaja, & Horelli, 2004) at the price of the school authorities (Thomson, 2005).

Continuous sitting in a forward bending position places physical stress on the muscles, ligaments and on vertebral discs. (Bendix, 1987; Brunswic, 1984). For the prevention of musculoskeletal disorders experienced by students, it is important to maintain correct standing and sitting postures while sitting in classrooms. (Cranz, 2000). The human body does different physical movements like leaning forward in an upright position

supported by the vertebral column which has a multi-curved appearance and aligning the body parts around it, with its centre of gravity located in the lumbar region of the trunk. Also, a curvature in the neck region supports the front and back movements of the head. For giving space for the chest organs within the rib cage, and to counterbalance the hip, the vertebral column takes an 's' shape, with the upper thoracic and lower lumbar curvatures positioned opposite to each other (Chakrabarti, 1997).

This study draws from Keegan's work (1962) on body postures and movement who took a series of x-rays of people changing position from lying to standing and reported the major movements that occur in the lumbar section of the spinal column (Fig. 1a), to right angle sitting (Fig. 1c) and bent-over positions (Fig. 1c). Fig. 1b is the natural resting position, while sleeping on a side. The lumbar curve is retained, and the muscles are relaxed and well-balanced. A sitting posture which is the natural resting position (Fig 1d), is a more suitable position and allows the spine to carry the body weight in a more comfortable way. This is 'balanced seating.'

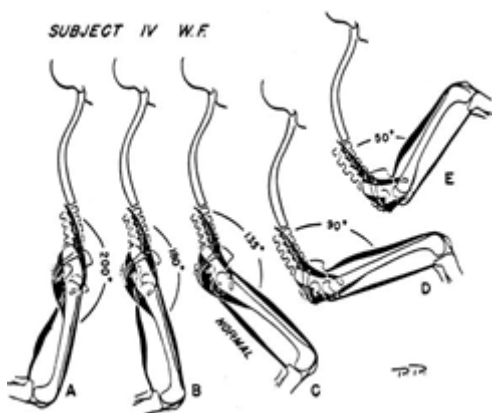


Fig. 1. Effects of altering the thigh-trunk angle in the lateral recumbent posture.

Source: Keegan JJ. Alterations of the lumbar curve related to posture and seating as cited in the Journal of Bone and Joint Surgery, 1953

Knight and Noyes (1999) also highlighted the significance of two different ways of sitting, i.e., going backward while relaxing or looking

at the board, and forward bending while reading or writing. Although the straight posture may look aesthetic but is possible to keep up this posture for one or two minutes and cannot be sustained for long periods. As a result, it leads to tiredness and pain, eventually causing an involuntary shift to bad posture.

In the sitting position, a forward leaning posture is most commonly adopted during writing, but it is also used for various other tasks too. School children spend approximately 80% of their classroom time in this forward leaning position at their desks, as writing tasks occupy most of their daily routine. (Hira, 1980).

By leaning their seats forward, school children prevent twisting their backs, letting the front and back muscles ease out so that they sit in a relaxed position.

Knight and Noyes (1999) also observed that the activities performed by children let them acquire different physical postures. High instances of uneasiness, especially in the neck and back are reported by various research studies for school children in schools. Such musculoskeletal symptoms often impair children's comfort and long term health, thereby affecting their performance in school. Researches have also shown that uncomfortable and inadequate sitting postures while sitting in classrooms are major contributors to children's musculoskeletal discomfort.

Children and Health Disorders

Studies conducted to examine the effects of continuous sitting and uncomfortable postures in schools on health of children point out several repercussions – back, neck, lumbar and leg tiredness (Daneshmandi, Isanezhad, Hematinezhad, 2008); musculoskeletal spasms on their right hand, back, neck, right shoulders, right elbow and right wrist (A.I Musa, S.O. Ismaila and O.D. Akinyemi, 2011). It was found that school children experienced backache and 8 to 12 years age group experienced lesser lower

back pain in comparison to children of 13 to 14 years of age (Mierau, 1989, Troussier et al., 1994, Burton et al., 1996).

Rationale of the Research Study

In the previous decade, interest in studying the sitting posture of school children based on the body mechanics has increased. School children are often seen spending their maximum time sitting in classrooms either forward leaning while writing and reading, or sitting pushing their back while listening to the teacher. School children who sit for prolonged hours are at a significantly increased risk of experiencing the adverse effects associated with poor sitting postures.

Specific Objectives

- To identify the various activities that school children engage in during school hours, particularly those requiring prolonged sitting.
- To observe and analyse the sitting postures adopted by school children while performing different classroom activities.
- To assess the incidence of musculoskeletal discomfort among school children resulting from extended periods of sitting in the classroom.

Methodology

Selection of Locale and Sample

The research was conducted in five public schools selected from different regions of Delhi. Sample for the study consisted of both children and teachers. After identification of the schools, the researcher visited the schools, obtained permission from school authorities and selected 450 students and 50 teachers.

Systematic sampling method was employed to select the participants. Thirty students (15 boys and 15 girls) from Classes VI, VII, and VIII representing the age groups of 11, 12 and 13 years from each school were

selected randomly. Randomization was followed even for selecting the sections. This was done by picking random numbers. Through systematic sampling the first unit was chosen randomly, and subsequent units were selected at every fifth interval.

Tools and Techniques of Data Collection

To fulfil the objectives of the study, the following tools and techniques of data collection were used:

- Classroom observation checklist was used to study the different activities school children were engaged in during the school hours, especially during sitting in the classroom. Physical observations were carried out by the researcher during the classroom hours. Video documentation was done for ease of data collection and to facilitate analysis of data.
- Questionnaire adopted from the standardized Nordic questionnaire for examination of musculoskeletal indications (Kuorinka et al., 1987) was employed to find out musculoskeletal discomfort experienced by children. The questionnaire included questions on experience of musculoskeletal aches in different body parts, degree of pain and frequencies of pain, etc. The questionnaire was administered to the students during physical education classes or during their arrangement classes for ease of the data collection.
- Questionnaire cum interview schedules were prepared for school children and teachers. A few open-ended questions were also incorporated in the questionnaire cum interview schedule for school teachers in order to find out their views regarding the comfortability of furniture in the classrooms.

Results and Discussion

To study the effects of prolonged sitting among school children in schools, the results and discussion focus on the activity

pattern of school children that children engage in while seated in the classroom. As movement is an integral part of the young child's life and education, for it is through movement that children develop social, emotional, and cognitive skills. For this reason, the study also considers children's participation in physical activities outside the classroom. Postural stress is not only faced by school children while sitting or standing but also by the way they sit on classroom furniture, as incorrect postures may cause pain in various parts of the body. Therefore, forward bending while sitting has been analysed in relation to the musculoskeletal discomfort reported by students during school hours.

Activity Pattern of School Children

The activity pattern of the children constituted the physical context for this study. In accordance, the first objective of the present study was to examine the

activity pattern of school children while seated in the classroom. The school authorities reported that children spend approximately six to seven hours per day in schools performing various activities, of these about six hours involved sitting for extended and continuous periods.

Regarding the activities performed by the school children while seated in the classroom, analysis indicated that listening to the teacher, reading, writing, crafts and drawing were some of the activities undertaken by them. The data showed that 82.9% of the school children were involved in reading activity, whereas 84.4% of them were involved in writing as classroom tasks. Moreover, 86.9% of school children reported actively listening to the teacher (Fig. 2). Apart from these activities, art and craft and certain other activities such as leisure reading, watching presentations on screen, quizzes, etc. were also found to be undertaken by the school children.

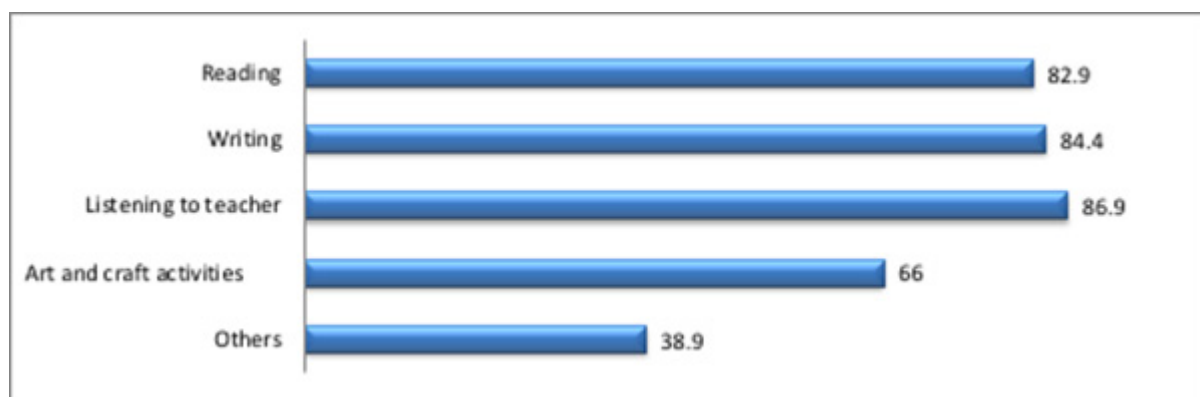


Fig. 2: Activities performed by children in the classroom

It was also observed that most of the children were seated while performing these activities. For conducting the activities, it is important for schools to have adequate classroom space as their immediate environment. It was further found that the children were performing these activities in a classroom environment that was not designed to support the activities they perform while seated. In spite of the significance of school spaces in the lives of children, lawmakers and school management overlook the needs

and demands of children while planning and constructing school environments (Hart, 2002; Matthews & Limb, 1999; Spencer & Wooley, 2000). When building the schools, children's spaces are often compromised by average design and construction standards (Catling, 2005; Collins & Colmen, 2008; Tanner, 2000). Similar situation was observed in the current study where there was an absence of ergonomically designed spaces for children in school classrooms. As also stated by Chakrabarti (1997)

proper space for children's movement in classrooms should be considered.

Analysis of the data further revealed that along with undertaking these compulsory activities, students participated in significant physical activities outside the classroom. These included outdoor games, athletics, cultural, yoga, karate, etc. The school administration reported that besides the academic activities, physical activities were also given due importance in the curriculum because physical activity is particularly essential for the good health and well-being of children. It was found that 86% of school children participated

in physical activities during school hours. This in-activity can pose several health-related risks among children as argued by several scholars (Twisk, J.W. et al., 1997). Data was further scrutinized for student's participation in physical activities both as per their age and gender. The analysis indicated that as far as gender was concerned, 52.9% girls and 47.1% of boys in 10-11 years age group, 48.7% girls and 51.3 % boys in the 12-13 years age group and 50.8% boys and 49.2% girls in >13 years age group were found to be taking part in physical activities outside the classroom (Table 1).

**Table 1 : Children's participation in physical activities outside the classroom
(Age and Gender-wise comparisons)**

Participation in Physical Activities				
Age	Gender	Yes	No	Total
10-11 years	Boys	66 (47.1)	10 (52.6)	76(47.8)
	Girls	74 (52.9)	9 (47.4)	83 (52.2)
	Total	140 (100)	19 (100)	159 (100)
12-13 years	Boys	60 (51.3)	14 (56)	74 (52.1)
	Girls	57 (48.7)	11(44)	68 (47.9)
	Total	117 (100)	25 (100)	142 (100)
>13 years	Boys	66 (50.8)	9 (47.4)	75 (50.3)
	Girls	64 (49.2)	10 (52.6)	74 (49.7)
	Total	130 (100)	19 (100)	149 (100)
Total	Boys	192 (49.6)	33 (52.4)	225 (50)
	Girls	195 (50.4)	30 (47.6)	225 (50)
	Total	387 (100)	63 (100)	450 (100)

Note: Figures in parentheses represent percentage

On the whole when combining all age groups, 49.6% of boys reported participation in physical activities, while girls reported for 50.4%. This suggests a near equal number of distributions, however, a slightly higher percentage of boys (52.4%) reported not participating in physical activities compared to girls (47.6%). The slight decline in the participation in physical activities among girls could be attributed to biological and social factors, including discomfort and reduced interest following the onset of

puberty. Similar findings have been reported by Moitra et al, (2021) and Kumar and Shirley (2019) who identified significant gender differences in moderate to vigorous activity levels. In addition, national reports (Katapally, T.R., 2016, Bhawra, J., 2018) highlight that physical inactivity is linked to economic burden and presents a major public health challenge in developing countries such as India.

Hence, regular physical activity is important and must be employed from an early

age. It requires an integrated perspective from all sections, especially from health professionals, teachers and parents to impact the understanding, viewpoints and conduct of young people for physical activities (Rogol et al., 2000).

Research has also indicated that for children, physical activity and movement enhances fitness, fosters growth and development, and helps teach them about their world. Movement is a critical means of conveying, voicing, and studying in young children. It is pertinent for educators to give children as many chances as possible to be physically active in order to learn through movement (Nichols, 1994).

Forward Bending Posture Adopted by Children

Another objective of the study was to observe and analyse the posture of school children

while they perform various activities while sitting in the classroom. To fulfil this objective the data was gathered through a structured questionnaire to enquire about the problems faced by children while maintaining posture, while sitting in the classroom.

The researcher observed that most of the school children were adopting a forward bending posture to read and write while sitting in the classroom. Mandal's (1981) reported that children take a natural relaxed back position was supported to some extent as it was found that 67.7% of school children were leaning forward while performing on the desk.

Age-wise comparison of the data showed that 34.8% in the 10-11 years age group, 32.8% in the 12-13 years age group and 32.5% of school children in the age group >13 years while doing sitting chores reported forward bending on the desk.

Table 2: Forward bending posture adopted by children (n-450)

Forward Bending posture while working on the desk	10-11 years	12-13 years	>13 years	Total
Yes	106 (34.8)	100 (32.8)	99 (32.5)	305 (67.7)
No	52 (36.1)	42 (29.2)	50 (34.7)	144 (32)
NR	1 (100)	0 (0)	0 (0)	1 (0.3)
Total	159 (35.3)	142 (31.5)	149 (33.1)	450 (100)

Note: Figures in parentheses represent percentage

Observational study suggested that children most often adopted forward-leaning postures which have been associated with back aches (Murphy et al., 2007). Bridger and Bendix (2004) suggested that pre-existing back pain is often exacerbated by poor seating positions.

Floyd and Ward (1969) considered the most common postural positions adopted in the classroom and observed that some children spent up to 80% of their time in a forward-slanting posture. Also, similar trend has been noted even in the present study, wherein 67.7% of school children were sitting on the

furniture in a forward-bending position.

Children's Self-reported Pains while Seated in Classrooms

While sitting in the classrooms school children adopted various postures to perform different activities and often felt discomfort due to inadequate furniture design. In the present study children were asked to indicate any pain experienced by them in their body particularly while seated.

To obtain detailed information on the discomfort experienced by children while being in the classroom the students were

asked to indicate the pain felt by them in different body parts including the wrist joint, lower arm, upper arm, shoulder joint, lower leg, hip and knee joint and others. The results

tabulated in Figure 3 show the various body parts of children they reported having pain in while doing chores in the sitting position in the classrooms.

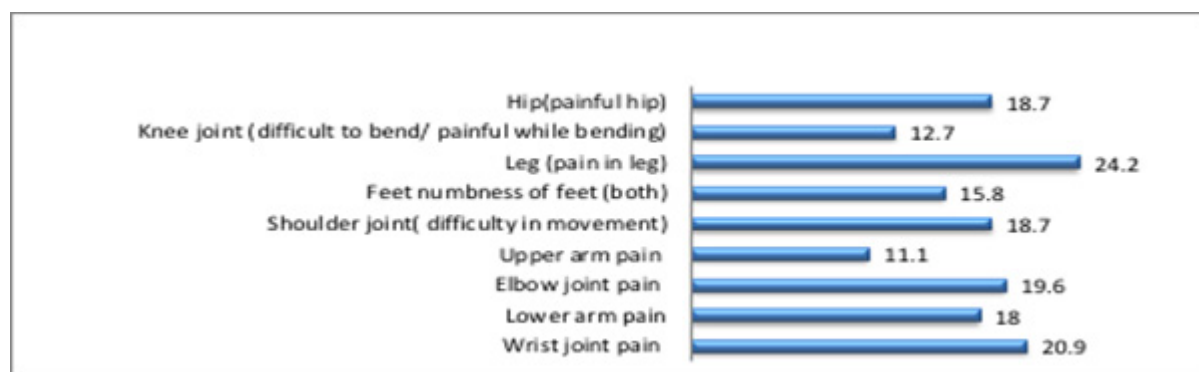


Fig. 3: Pain experienced by school children while working in class (n=450), only 'yes' responses (Multiple responses allowed)

Out of the total sample, 24.2% children experienced pain in leg, 20.9% in the wrist joint, 19.6% in the elbow joint, 18.7% in the hip, 18.7% in the shoulder joint, 18% in the lower arm, 15.8% reported feet numbness, 12.7% in the knee joint, and 11.1% in the upper arm.

Population based studies have revealed that the lifetime prevalence of musculoskeletal discomforts in children and adolescents ranged between 7 and 63% (Kovacs et al., 2003).

Body Pains Experienced by Children (age-wise and gender-wise comparison)

A standardized Nordic questionnaire for examination of musculoskeletal indications (Kuorinka et al., 1987) was employed which used body map a kind of pain drawings in which children had to mark the area where they felt pains. As the experience of pain is subjective, children's self-reports are considered valid and reliable tools for assessing body pain. A research study by Schott, 2010 also supports this view, wherein Pain Drawings (PDs) were used for respondents to mark the area or colour on

a standardised body chart for assessing the pain experienced by them. The results showed that a greater percentage of girls felt pain in the fingers, shoulder joints, wrists joints, elbow joints, knee joints, arms, thighs, and finger, shoulder joint, wrist joint, elbow joint, knee joint, arm, thighs and hips in the 10-11 years and 12-13 years age group. However, there was a decrease in reported pain among girls in the >13 years age group. As also can be seen from Table 3, girls from the age group of 10-13 years expressed more bodily discomfort than the girls of >13 years age group. This could be due to the physiological changes associated with puberty, which may increase bodily discomfort during this period.

The results also highlighted that more girls than boys reported pain in lower body parts such as thighs, lower legs, and feet (Table 3). This could be due to gender disparities as the bodily traits and biological features of males and females differ significantly. Males and females vary in their muscle strength as females generally have lower muscle strength than males, (Katzmarzyk et al., 1998).

Table 3: Body pains experienced by children (n-450)

Part of body experiencing pain	Boys				Girls				Total			
	10-11 Years	12-13 Years	>13 Years	Total (n-225)	10-11 years	12-13 Years	>13 years	Total (n-225)	10-11 years	12-13 years	>13 years	Total (n-450)
Fingers	35 (37.2)	37 (39.4)	22 (23.4)	94 (41.8)	34 (36.2)	36 (52.2)	24 (32.9)	94 (41.8)	69 (36.7)	73 (38.8)	46 (24.5)	188 (41.8)
Wrist joint	28 (40.6)	27 (39.1)	14 (20.3)	69 (30.7)	33 (42.3)	36 (59)	9 (14.3)	78 (34.7)	61 (41.5)	63 (42.9)	23 (15.6)	147 (32.7)
Arm	23 (35.4)	30 (46.2)	12 (18.5)	65 (28.9)	30 (43.5)	28 (52.8)	11 (19)	69 (30.7)	53 (39.6)	58 (43.3)	23 (17.2)	134 (29.8)
Elbow joint	27 (41.5)	27 (41.5)	11 (16.9)	65 (28.9)	29 (42)	32 (57.1)	8 (13.6)	69 (30.7)	56 (41.8)	59 (44)	19 (14.2)	134 (29.8)
Shoulder joint	29 (38.7)	32 (42.7)	14 (18.7)	75 (33.3)	30 (39)	35 (59.3)	12 (17.9)	77 (34.2)	59 (38.8)	67 (44.1)	26 (17.1)	152 (33.8)
Feet	25 (39.7)	27 (42.9)	11 (17.5)	63 (28)	30 (40.5)	31 (56.4)	13 (22.4)	74 (32.9)	55 (40.1)	58 (42.3)	24 (17.5)	137 (30.4)
Lower leg	27 (39.1)	28 (40.6)	14 (20.3)	69 (30.7)	31 (39.7)	30 (51.7)	17 (29.3)	78 (34.7)	58 (39.5)	58 (39.5)	31 (21.1)	147 (32.7)
Knee joint	26 (38.8)	25 (37.3)	16 (23.9)	67 (29.8)	30 (42.9)	31 (55.4)	9 (16.1)	70 (31.1)	56 (40.9)	56 (40.9)	25 (18.2)	137 (30.4)
Thighs	19 (33.3)	25 (43.9)	13 (22.8)	57 (25.3)	27 (38)	34 (73.9)	10 (16.9)	71 (31.6)	46 (35.9)	59 (46.1)	23 (18)	128 (28.4)
Hip	20 (31.3)	28 (43.8)	16 (25)	64 (28.4)	29 (42.6)	27 (55.1)	12 (21.8)	68 (30.2)	49 (37.1)	55 (41.7)	28 (21.2)	132 (58.7)
Neck	27 (37)	31 (42.5)	15 (20.5)	73 (32.4)	36 (40.9)	36 (57.1)	16 (23.9)	88 (39.1)	63 (39.1)	67 (41.6)	31 (19.3)	161 (71.6)

Note: Figures in parentheses represent percentage. Percentages have been calculated for yes responses in the particular age group.

On further comparing the three age groups, it was found that the maximum percentage of pain in body parts was felt by children of the 12-13 years age group. This showed that the pain prevalence in body parts increased as children progressed from 10-11 to 12-13 years. This could be due to pubertal changes and the corresponding increase in anthropometric measures as they grew older. The pain experienced by school children decreased among children in the >13 years age group. This may be because, as they grew older, they became accustomed to classroom furniture and made adjustments, albeit potentially comprising their posture. It was found that among the total sample, the highest percentage of pain was reported in the elbow joint (41.8%) for the 10-11 years

group, in the thighs (46.1%) for the 12-13 years group, and in the lower leg (21.1%) for the >13 years group.

Back Pain Reported by School Children

A total of 14.1 % of school children reported 'always' having back pain, whereas 46.4% school children reported having back pain 'sometimes' during the day (Table 4). On the other hand, 39.5% never had any back pain while seated. Further, analysis showed significant differences among the children of 10-11 years, 12-13 years and >13 years age group. This is of significant worry taking care of the comparatively young age of the respondents (10-13 years).

Table 4: Frequency of back pain experienced by child\ n (age wise comparison) n-450

Back pain	10-11 years	12-13 years	>13 years	Total	χ^2 value	Sig
Always	16 (25.3)	29 (46.03)	18 (28.5)	63 (14.1)	12.947	.012*
Sometimes	71 (34)	58 (27.8)	80 (38.3)	209 (46.4)		
Never	72 (40.4)	55 (30.9)	51 (28.7)	178 (39.5)		
Total	159 (35.3)	142 (31.6)	149 (33.1)	450 (100)		

Note: Figures in parentheses represent percentage, *significant at .05 levels

Gender-wise comparison of back pain experienced by school children showed that 49.2 % of boys and 50.8% girls were hurt from back pain. Further, it was seen that a greater percentage of girls reported 'always' having back pain than boys of 10-11 years (53.8% of girls and 46.2% of boys) and 12-13 years age group, i.e. 53.6% of girls and 46.4% of boys. Contrary to this, more boys, i.e. 55.6% of boys and 44.4% of girls reported back pain in >13 years age group (Fig. 4).

An increase in back pain was prominent in girls from 10 to 13 years, whereas >13 years age group, greater percentage of boys reported having back pain. This might be due to sudden transition in their stature from 6th to 7th grade and greater percentage of

boys participating in sports. These findings are in conformity with the studies, wherein it was reported that a greater possibility of back pain had been related with a high level of physical exercise (Balague et al., 1995; Kujala et al., 1999; Jones et al., 2003).

Lebouf-Yde and Kyvik (1998) suggested that premature onset of puberty can be a feasible cause for increased account of back ache among females. On the other hand, Balague et al., (1995) speculated that the traditional image of the male cause boys to downplaying their back ache while Salminen (1984) suggested that boys may repudiate their back ache signs and subsist or agonize about their symptoms less (Salminen et al., 1992).

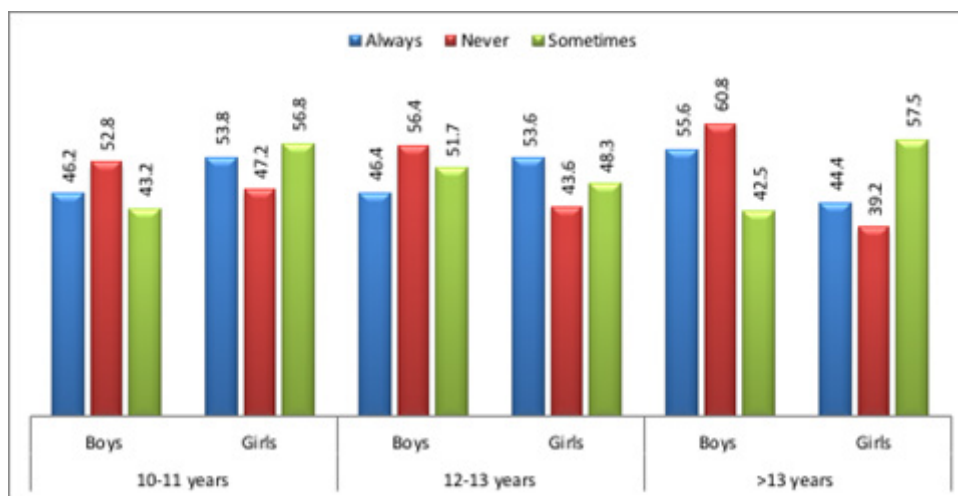


Fig. 4: Back pain experienced by school children (gender-wise and age-wise comparison)

The amalgam of bad posture and poor seating integrated with long span of

stillness can lead to the cause of lower back pain (Genaidy, 1993, Moore et al., 1992).

Neck Pain Experienced by School Children

Neck pain was experienced by school children, followed by other pains as reported by earlier findings. A higher percentage of boys reported having 'always' than girls for all the three age groups, i.e. 60% of boys and 40% of girls from 10-11 years, 58.6% of boys and 41.4% of girls from 12-13 years, 60% of boys and 40% of girls from >13 years, 60% of

boys and 40% of girls from >13 years (Fig. 5). The greater percentage of boys reporting neck pain could be because of their higher stature measurements in comparison to girls and hence, they had to adopt a forward leaning posture. As per Murphy et al. (2007) when school children feel discomfort for a continuous span of time, they may have to take on bended or static postures thus causing muscular tiredness in the neck.

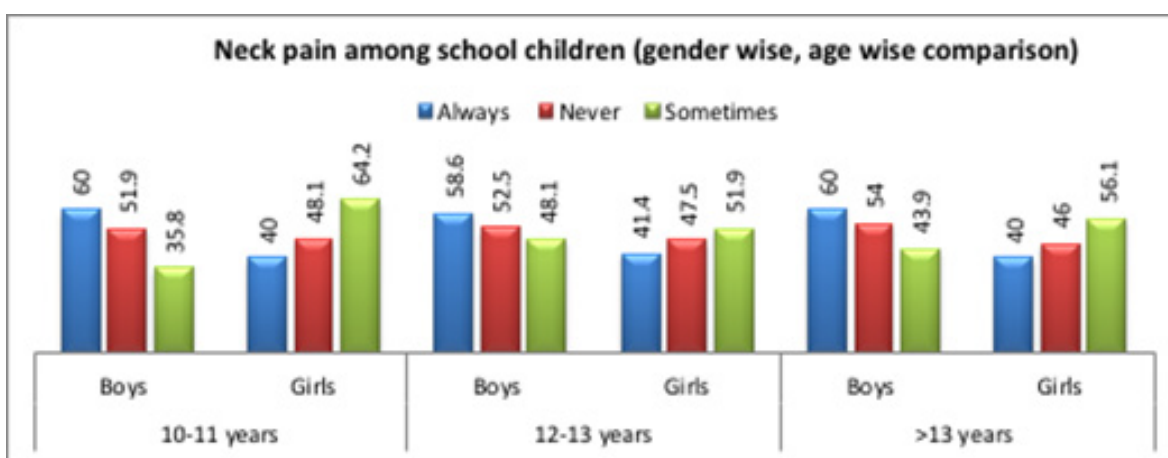


Fig 5: Neck pain among school children (age-wise and gender wise)

School children's sitting posture might be the principal factor that impacts musculoskeletal disorder (MSD). The cause of MSD can also be varied in nature (Chiang et al., 2006). It was found that in boys there is a greater occurrence of musculoskeletal pain than in girls. This could be due to gender disparities as the bodily traits and biological characteristics of boys and girls are different. Mandal (1982) in his research described that 60% of school children while sitting in classrooms accounted for pains in back, neck or shoulder. Salminen et al., (1992) also reported that low back pain was due to an unsuitable school table.

Conclusion

School is an institution that serves as a second environment after home, designed to enhance children's learning. During their growing years, children spend about a quarter of their day at school, with

approximately 80% of this time spent sitting while performing various activities. Considering the amount of the time spent at school and specifically while sitting, it is essential that school furniture be suitable for the children's physical needs (Savanur et al., 2007) and should support changing postures (Yeats, 1997). A conducive and comfortable classroom environment motivates the students to perform better and encourages the learning process. School work requires them to sit for extended periods of time (Freudenthal et al., 1991; Knight and Noyes, 1999).

During growing years, children undergo many changes that are anatomical, physiological, and psychological in nature. Further school children's stationary and forward-leaning postures place considerable physiological strain on muscles, ligaments, and especially on the vertebral discs. Accurate standing and sitting posture is a primary factor in

preventing musculoskeletal symptoms among children.

Poor posture can be a starting point for fatigue, strain, pain and may result in structural distortion of the body, with muscle cramps, pain in the back and legs, reduced lung capacity, poor circulation, kinks in the bowel and many non-uniformities in the function of the body. The human body is designed to be in motion and the advantages of sitting can only be attained through good posture and exercise.

During the past decade, studies for school children have generated a lot of interest in maintaining their sitting posture based on the biomechanics of the human body. However, relatively little attention has been given to the largest workplace of all – the school. School children are at special risk of suffering from the ill effects of poor postures acquired during prolonged seated periods at school. Hence, more research studies need to be conducted to promote awareness to bring changes in the school environment for the benefit of the children.

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A Study of Mathematical Patterns and Cultural Symmetry in Traditional Weaving, Beadwork, and Basketry

Vivek Kumar Rawat *, M.T.V. Nagaraju

Abstract

Traditional weaving, beadwork, and basketry from diverse Indian cultures exhibit mathematical patterns and cultural symmetry that coexist with a variety of mathematical principles. This research paper explores the geometrical structures that are present in the form of tessellations and symmetry in the crafts of Double Ikat of Patan Patola, symmetric motifs in Kanchipuram silk, and radial symmetry in Naga beadwork. The researchers also examine the mathematical ideas behind Banjara embroidery, Toda basketry, and Khasi bamboo weaving, and show how some fundamental concepts, including permutations, combinations, tessellations, and geometric transformations can be applied in some of their creations. The analysis concludes that ethno mathematics is essential in maintaining indigenous knowledge, especially in its application of mathematical principles in a way that artisans naturally employ in the process of producing visually balanced and structurally precise designs. This paper aims to establish ethno mathematics as both a valid cultural epistemology and a pedagogical tool for culturally responsive mathematics education.

Keywords: Weaving, Beadworks, Basketry, Mathematical patterns, Cultural symmetry.

Introduction

In the pattern of certain traditional handicrafts, mathematics is deeply embedded in the form of intricacy in patterns and symmetry in design (Firdaus & Nasution, 2023). Within practices such as weaving, beadwork, and basketry, cultural knowledge bearers intuitively apply mathematical principles to produce artefacts that are both aesthetically appealing and structurally precise. Aside from being aesthetic and functional objects, these crafts constitute a large repository of indigenous mathematical ideas that have been transmitted from generation to generation.

Ethno mathematics is an interdisciplinary field that studies the link between cultural

practices and mathematical concepts, which is based on mathematical patterns in typical craftsmanship (Khalil, 2023). Since the researchers study only geometric arrangements, tessellations, and symmetric designs in textiles and handicrafts, they gained insight into how the artisans incorporate the theory of symmetry, proportions, and numbers without any formal mathematical training (Firdaus & Nasution, 2023).

The present research paper focuses on the mathematical structures found in traditional weaving, beadwork, and basketry among various Indian communities and examines how the art forms employ geometric shapes, permutations, and symmetrical patterns

as an expression of ethno mathematics, reflecting both cultural meaning and mathematical reasoning.

The researchers reviewed the secondary sources, such as ethnographic studies, museum archives, and scholarly articles, and identified the major art forms where mathematical ideas are visibly present. On this basis, weaving, beadwork, and basketry were selected as representative examples for ethno mathematical analysis. This research demonstrates how mathematical ideas are already embedded within cultural heritage, showing that indigenous activities express mathematical concepts through practices such as weaving, beadwork, and basketry, and how this knowledge can be applied in the present-day situation.

Ethno mathematics: A Cultural Epistemology

Ethno mathematics, as understood by D'Ambrosio (2006), is more than the traditional sense of mathematics being an ahistorical, culturally neutral discipline. Rather, it puts greater emphasis on human sources of mathematical innovation and locates mathematics within the everyday activity of specific cultural groups. Through such multiplicity, the field recognizes the existence of multiple forms of mathematical thinking as a result of problem-solving in daily life, symbolic representations, and artistic work (Khalil, 2023). Mathematics, as developed through this understanding, is not only a tool of abstraction but a culturally embedded practice of any human activity, which develops according to human wants, aesthetic ideals, and socio-cultural interaction, such as in Patan Patola weaving, community guilds transmit symmetry-based grid patterns across generations, embedding mathematical order within cultural rituals of cloth-making. In Kanchipuram silk, triangular motifs reflect both the social value of temple architecture and the artisan's mathematical

reasoning about stability and proportion. Similarly, Naga beadwork encodes clan identity through combinatorial colour arrangements, where mathematical choices are inseparable from social affiliation. These examples illustrate how mathematical structures emerge directly from cultural practices and community life.

The mathematical reasoning is embedded into the culture in the example of traditional weaving. The persistence of pattern designs, the rigor of repeated motifs, and the instinctive spatial thinking that is apparent in crafts with patterning, such as in Patan patola and Kanchipuram silk, are all products of indigenous mathematical logic. These activities are not scaled-down versions of modern mathematical practices that operate on various levels on their own conceptual and methodological levels. More so, ethno mathematics leads to linguistic and cultural pluralism. Different communities maintain their own symbolic systems and mathematical idioms, which reflect diverse ways of reasoning and problem-solving. In this sense, ethno mathematics supports the idea of epistemological pluralism that there are multiple valid ways of knowing mathematics. Forms of such pluralism include indigenous spatial reasoning in weaving, symbolic colour codes in beadwork, and oral traditions that transmit counting and measurement practices. These differ from the dominant epistemology of Western mathematics, which assumes universality, abstraction, and cultural neutrality. By contrast, epistemological pluralism recognizes mathematics as context-bound, situated in culture, and expressed through material practices. In pedagogy, this contrast is crucial, whereas universalist approaches often reduce cultural artefacts into decontextualized textbook problems, a popularist approach values the cultural logic embedded in traditional designs, thereby promoting inclusivity and fairness in mathematics education.

Mathematics as a Human Cultural Act

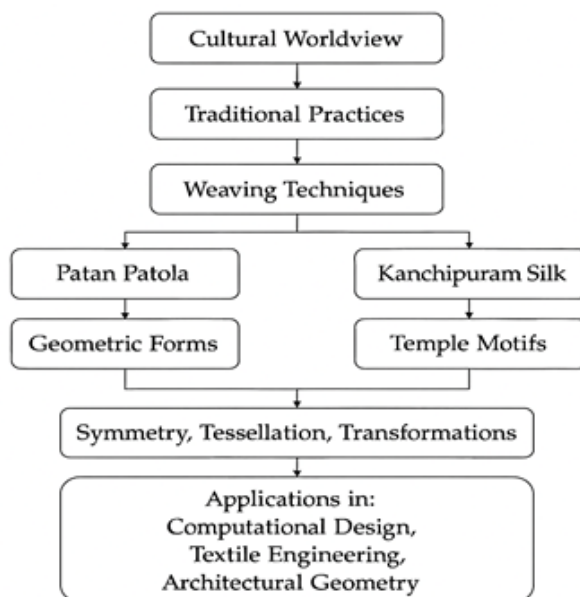


Fig. 1 Conceptual Design (Image source: Authors)

The concept of mathematics must thus be envisioned beyond the realms of abstract thinking; however, mathematics can be presented as a culturally ingrained activity rooted in material life, shared practice, and interaction with signs within the environment. In the Indian context, one can find evidence of this thesis with reference to traditional crafts (Patan Patola, Kanchipuram silk weaving), where mathematical concepts are ferociously intertwined with material culture.

The utilization of repeating squares, triangles, and tessellated patterns in these fabrics is not coincidental in the slightest: the visual language corresponds to many remotely cosmological, communal, and religious belief archetypes (Dewi Pebryani, 2018; Keerthi & Mokanaa Sri E, 2024). The geometric patterns are amazingly precise and were frequently developed by formally untrained geometric builders, thus showing a type of local mathematical literacy that is simultaneously intuitive and rigorous.



Fig. 2 Patan Patola Art
(Source: <https://images.app.goo.gl/ZBWgabUB9xf1wkBM7>)



Fig.3 Kanchipuram Silk Design
(Source: <https://images.app.goo.gl/VLR9an8FM19U8BAcA>)

²Kanchipuram silk is a hand-woven textile from Tamil Nadu, recognized for its temple-inspired motifs, triangular borders, and cultural significance in South Indian traditions.

Balamurugan (2015) noted that such type of mathematically motivated knowledge, which is naturally developed by generations of trade practice, forms a genuine and complicated system of discourse. Such a symmetrical grid pattern found in Patola, for example, not only communicates the aesthetic values but also reflects the cultural beliefs, in terms of order and harmony. Similarly, the triangular ornamentation of Kanchipuram sarees suggests the architectural style of temple towers, and, beyond decoration, conveys ideas of stability and auspiciousness. The repeated use of triangles is not incidental in geometry, the triangle is considered the most stable polygon, since once its sides are fixed, its shape cannot be deformed without altering its length. This property of rigidity is mirrored in weaving, where triangular motifs provide visual balance and symbolic strength, while also reinforcing the structural alignment of warp and weft threads. In this way, the design links geometric abstraction with both spiritual

expression and practical stability.

Today, the practicality of these classical forms of mathematical expression is manifest. The logic of design incorporated in these crafts aligns with the upcoming tendencies of computational textiles, algorithmic design, and architectural geometry. According to Firdaus and Nasution (2023), integrating the indigenous knowledge of mathematics within the contemporary modelling frameworks closes the gap between indigenous and scientific knowledge systems by incorporating the indigenous wisdom of scientists. The integration is visible in the textile engineering courses where the mathematical principles of traditional crafts are used to teach concepts of design and modelling. It is also evident in sustainable practices that adapt indigenous weaving and basketry techniques for modern applications. Together, these examples illustrate how ethno mathematics is gaining recognition as both a practical knowledge system and a growing epistemology.

Literature Review

Authors	Findings
Dominikus et al. (2023)	The study findings reflect that weaving activities in Timor Island reflect various ethnomathematical characteristics, including counting, locating, measuring, designing, explaining, logical implication, and estimating. These practices suggested mathematical concepts such as multiplication, parallel lines, geometric shapes, reflection, rotation, and units of measurement. The findings highlight weaving as a source of rich cultural resources for enhancing mathematics learning.
Fauzi et al. (2023)	The researchers examined that the traditional woven fabric motifs of the Sasak people, an indigenous ethnic group from Lombok, Indonesia, incorporate mathematical concepts such as lines, angles, flat shapes, and geometric transformations, including reflection, translation, rotation, and dilation. Each motif also reflects the cultural and philosophical values such as perseverance, harmony, patience, and sincerity. These findings highlight that Sasak woven fabrics serve not only as an artistic expression but also as a valuable resource for mathematics learning.
Enmufida et al. (2021)	The researchers investigated the integration of mathematics and culture by examining Minangkabau traditional songket weaving in Pandai Sikek, revealing mathematical concepts such as counting, measuring, designing, and geometric patterns within the weaving process. Songket is a kind of traditional Minangkabau woven fabric woven by hand using gold and silver threads, especially used in the Minangkabau ceremonies. Using a qualitative ethnographic approach, it highlights how weaving embodies mathematical ideas through activities like symmetry, reflection, and pattern design. The study demonstrates that mathematics is inherently linked to cultural practices, challenging the notion that the two exist independently.

Jalalimanesh and Xun (2021)	The researchers explored the role of the golden ratio and Fibonacci number sequence in art, architecture, and design, emphasizing their aesthetic harmony and mathematical precision. The golden ratio is an irrational number characterized by the Greek letter phi. They investigated their application in textile design through restructured Ming dynasty floral motifs, generating spirals and geometric patterns as decorative elements and emphasized how mathematical models enrich textile surfaces with cultural meaning, aesthetic value, and contemporary design applications.
Subanji et al. (2017)	The research describes the mathematical ideas of Adonara people engaged in the weaving practice. These indigenous inhabitants of Adonara island belong to the large group of Lamaholot speakers in Nusa Tenggara Timor, Indonesia. They are closely related socially and culturally, sharing an important history of weaving warp-ikat sarongs, or kewatek, with other Lamaholot-speaking people living in East Flores and on the surrounding islands of Lembata, Solor, coastal Alor, Ternate, and Buaya. The researchers investigated weaving traditions through Bishop's six mathematical activities – counting, locating, measuring, designing, playing, and explaining (CMLPDE) – as a framework to identify embedded mathematical ideas (Bishop, 1988). Emphasized ethno mathematics as a research and pedagogical approach that contextualizes mathematics learning while preserving cultural knowledge systems.

Objectives of the Study

1. To synthesize theoretical insights by linking craft-based mathematical reasoning with the broader framework of ethno mathematics as a cultural epistemology.
2. To interpret the cultural significance of mathematical patterns showing how designs like squares, triangles, colours, and circles express community beliefs, idea of stability, and symbolic values.
3. To study the mathematical patterns such as symmetry, tessellation, and geometric transformation embedded in traditional Indian weaving, beadwork, and basketry.

Methodology

This study adopts a qualitative interpretive approach to understand how mathematical structures and cultural meanings are embedded within traditional Indian crafts, specifically weaving, beadwork, and basketry. The research methodology combines visual analysis, semiotic interpretation, and secondary source synthesis, grounded within the theoretical lens of ethno mathematics.

Sample Selection and Rationale

Four traditional Indian crafts – Patan Patola (Gujarat), Kanchipuram Silk (Tamil Nadu),

Naga Beadwork (Northeast India), and Toda Basketry (Tamil Nadu) – were selected for in-depth analysis. These were chosen due to their:

- (a) high presence of symmetry, tessellation, and geometric motifs;
- (b) regional and cultural diversity across India;
- (c) documented pedagogical potential in ethnomathematics research; and
- (d) availability of rich visual and textual documentation

The samples were identified from:

1. Digital museum collections (e.g., Indira Gandhi National Centre for the Arts) accessible through the digital repository, which provides high-resolution images and cultural descriptions of traditional weaving and basketry;
2. Scholarly sources, i.e., peer-reviewed research articles and books on Indian textile traditions and ethnomathematics, such as Daniel et al. (2025); Keerthi and E (2024); Mehta (2020); Ndapa Deda and Amsikan (2019); Pebryani, D.N. (2018) which provide theoretical and mathematical interpretation of craft patterns.

All patterns included were selected based on their clarity, cultural authenticity, and mathematical richness.

Visual Analysis

The mathematical elements such as types of symmetry (reflectional, rotational, and translational), tessellation rules (edge-matching, repetition), geometric transformations, and combinatoric patterns in beadwork and embroidery were first identified from chosen samples. These elements were then examined through visual pattern analysis, in which patterns were redrawn and digitally annotated to map principles such as congruence, angle measure, and repetition cycle.

Semiotic Method

A semiotic framework was applied, drawing on Roland Barthes' notion of denotation and connotation. Denotation refers to the literal level of meaning, while connotation refers to the symbolic or cultural meanings (Barthes, 1964, 1972). In this study, denotative readings identified the visible geometric forms such as triangles, squares, and circles, whereas connotative readings revealed their cultural associations with cosmology, spirituality, and community identity.

Stage 1: Identification of Signifiers

Each visual motif, such as squares, triangles, circles, spirals, tessellated grids, symmetry-based arrangements, and colour-coded bead patterns, was extracted and classified based on shape, repetition, and orientation.

Stage 2: Contextual Mapping

The motif's cultural context was identified through anthropological literature, oral narratives, and historical symbolism.

Stage 3: Interpretive Synthesis

The relationship between form and cultural meaning was established using Barthes' denotation/connotation model, resulting in layered interpretations of the pattern's role in traditional belief systems.

Secondary Source Review

Secondary data played a vital role in contextualizing visual patterns. Sources included:

1. Ethnographic studies on textile symbolism and tribal art, such as Ascher (2004) on Inca and Indian weaving traditions, and Zaslavsky (1990) on mathematical symbolism in African textiles, which show how cultural motifs encode mathematical meaning;
2. Mathematical texts explaining tessellation and geometry, such as Grünbaum et al. (1987), who systematically classify tessellations, and Stevens (1980), who connects geometric patterning to traditional art forms; and
3. Indigenous knowledge system documentation and oral narratives such as D'Ambrosio (1985), who emphasizes ethnomathematics as a knowledge system, and Guru et al. (2022), who records oral traditions of craft and weaving in Indian tribal communities.

Each source was reviewed to triangulate visual interpretation, validate cultural meanings, and ground the mathematical analysis in historical practices. This approach ensured the findings were not solely observational but informed by cultural narratives and academic rigor.

Objective 1: To synthesize theoretical insights by linking craft-based mathematical reasoning with the broader framework of ethnomathematics as a cultural epistemology.

Theoretical Framework

This research work is based on the ethnomathematics framework that acknowledges the mathematical systems that are vested in cultural practices. Ethnomathematics seeks to debunk the view in the previous approach as a culturally neutral discipline because indigenous knowledge systems articulate mathematical ideas in art, craft, architecture, and ritual.

The research is embedded in such an ethno mathematical paradigm that is simultaneously decolonial and pluralistic, in the view of D'Ambrosio (1985). The paradigm argues that mathematics is a humanly constructed cultural praxis, which is guided by lived experiences within the community, material practices, and symbols of the community. Mathematics, therefore, is not a culture-independent abstraction but a contextual epistemology which arises out of continued interaction between human beings and their materiality as well as their symbolism. Ethno mathematical research has found special application in the examination of production systems based on crafts, due to their ability to incorporate mathematical concepts into sensory touch through the senses. The linkage between mathematics and culture in relation to indigenous craft traditions is displayed by D'Ambrosio (1985) by way of weaving, building, measuring, and designing, which are major modes of indigenous crafting practices. This orientation is taken up in the current research, where the textile and beadwork patterns are discussed as mathematical stories about how those patterns are created as an embodied, artisanal practice.

The articles by Zaslavsky (1994) and Ascher (2017) are additional sources that inform the work, challenging mathematical sophistication in African and Native American designs. Through their analyses, one can find how mathematical concepts, such as fractals, permutations, geometry, among others, are employed within the realms of ritual, narrative, and aesthetic space.

Knijnik (2002) provides a rigorous outlook by bringing out the mechanisms through which power relations and official forms of education oppress indigenous knowledge, thus arguing for pedagogical approaches that would demonstrate epistemological

pluralism. The educational implications presented in this article are informed by her understanding of ethno mathematical justice to make sure that indigenous ways of knowing are not simplified or distorted in terms of their formulation through craft-based mathematics learning.

Rosa & Orey (2010) also enrich the analysis with their socio-cultural model of mathematics education, accenting the importance of community-based knowledge systems, which are nevertheless different from the Western paradigms inasmuch as they provide explicitly logical structures, which, in turn, fit to be called mathematics. Both of their works on the dialogic pedagogy and inclusive curriculum design are interrelated with the educational implications that are seen in the course of this study.

These theoretical considerations are projected into the Indian setting, where the traditions of weaving, like Patan Patola and Toda basket-making, serve as autonomous systems of knowledge of mathematics. This intermingling of Brazilian, African, and Indian outlooks can decentralize the paradigms in formal schooling and bring to the fore indigenous logic and visual reasoning in terms of fundamental components around mathematical learning.

The study also makes use of concepts from:

- (a) Geometry and Symmetry Theory, to classify and to analyze patterns.
- (b) Semiotics to make the symbolic meaning of these patterns.
- (c) Cultural Anthropology with the view of positioning weaving in the context of societal tradition, gender roles, and storytelling.

Objective 2: To interpret the cultural significance of mathematical patterns showing how designs like squares, triangles, colours, and circles express community beliefs, idea of stability, and symbolic values.

Double Ikat Technique in Patan Patola

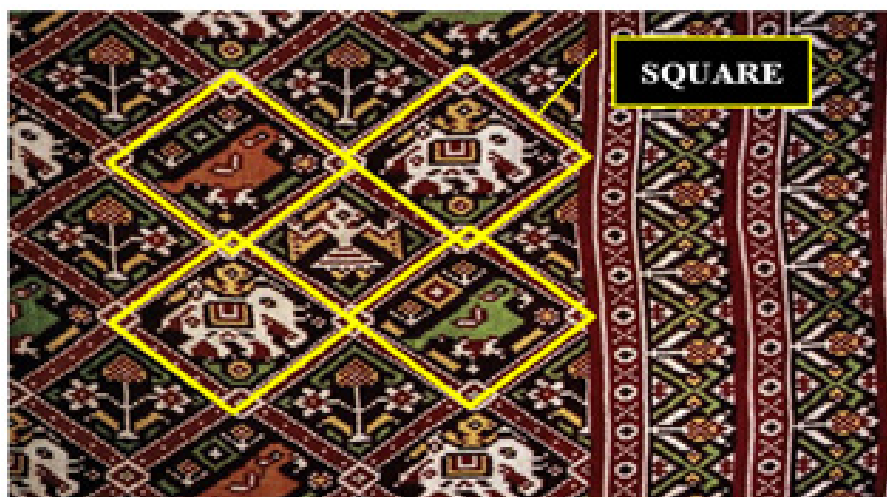


Fig. 4 Patan Patola art work (Source: <https://images.app.goo.gl/tDWGoFcuk8gdbYYt8>)

Cultural History

Gujarat, India, is globally recognized for its exquisite textile heritage, particularly the Patan Patola, a double ikat weaving tradition that dates back to the 12th century. Patan Patola sarees are famed for their vivid colours, intricate motifs, and cultural symbolism. The unique double ikat technique involves resist dyeing both the warp and weft threads before weaving, ensuring that the patterns

appear identically on both sides of the fabric, a hallmark of extreme precision and artisan mastery (Dewi Pebryani, 2018). The designs often include floral motifs, animal forms, and abstract figures arranged within structured grids, reflecting a deep alignment with Jain and Hindu cosmologies (Pebryani et al., 2020). These textiles are not only luxury artefacts but also vessels of cultural identity, spirituality, and artisanal lineage, passed down through generations within the Salvi community.

Kanchipuram Silk

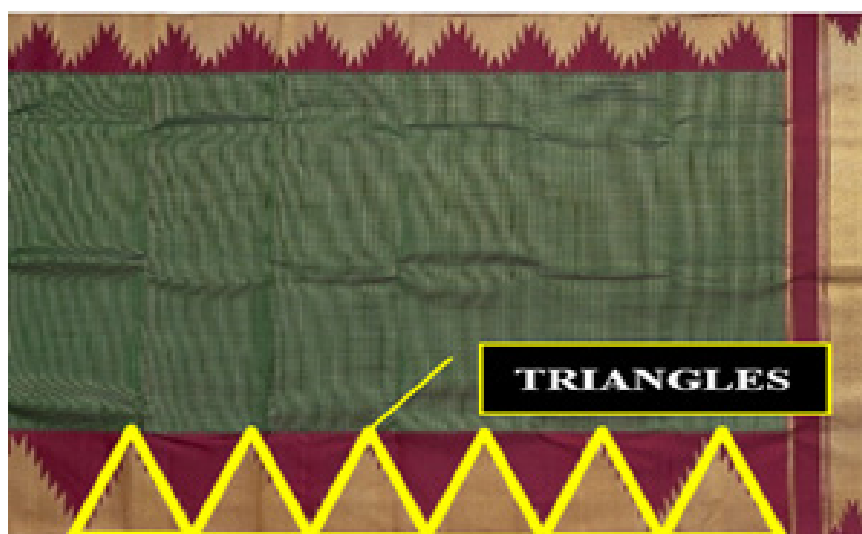


Fig. 5 Kanchipuram Silk Art (Source: <https://rmkv.com/blogs/posts/the-blessed-harvest-kanchipuram-motifs-inspired-by-abundance>)

Cultural History

Kanchipuram silk is a prestigious handwoven textile tradition from Tamil Nadu, India, renowned for its vibrant hues, intricate borders, and exceptional durability (Kawlra, 2005). Traditionally worn during rituals, festivals, and weddings, these sarees are deeply embedded in South Indian cultural

identity. The hallmark of Kanchipuram sarees lies in their contrasting pallus and temple-inspired borders, often embellished with geometric and symbolic motifs that reference natural and sacred forms. Among these, triangular motifs dominate the border patterns, reflecting both aesthetic sensibility and spiritual symbolism linked to South Indian temple architecture (Keerthi & E, 2024).

Naga Beadwork



Fig. 6 Naga Beadwork Design (Source: <https://www.wxgsales.site/?ggcid=4300790>)

Cultural History

The Naga tribes of Northeast India possess a rich tradition of beadwork that holds deep cultural and symbolic significance. Adornments such as necklaces, headbands, and breastplates are crafted using meticulously arranged beads in complex patterns that vary across tribal groups (Odyuo, 2013). These patterns are not merely

aesthetic; they serve as visual markers of identity, rank, marital status, and clan affiliation (Kanungo, 2006). Each tribe employs its own colour codes and motifs, making Naga beadwork a dynamic language of heritage and social communication. The act of bead arrangement itself is an intuitive design tradition passed down through generations, reflective of both artistic ingenuity and cultural continuity.



Fig. 7 Toda Basket Design (Source: <https://www.countryseat.com/spiral-bread-basket-pattern-by-hawkins.html>)

Cultural History

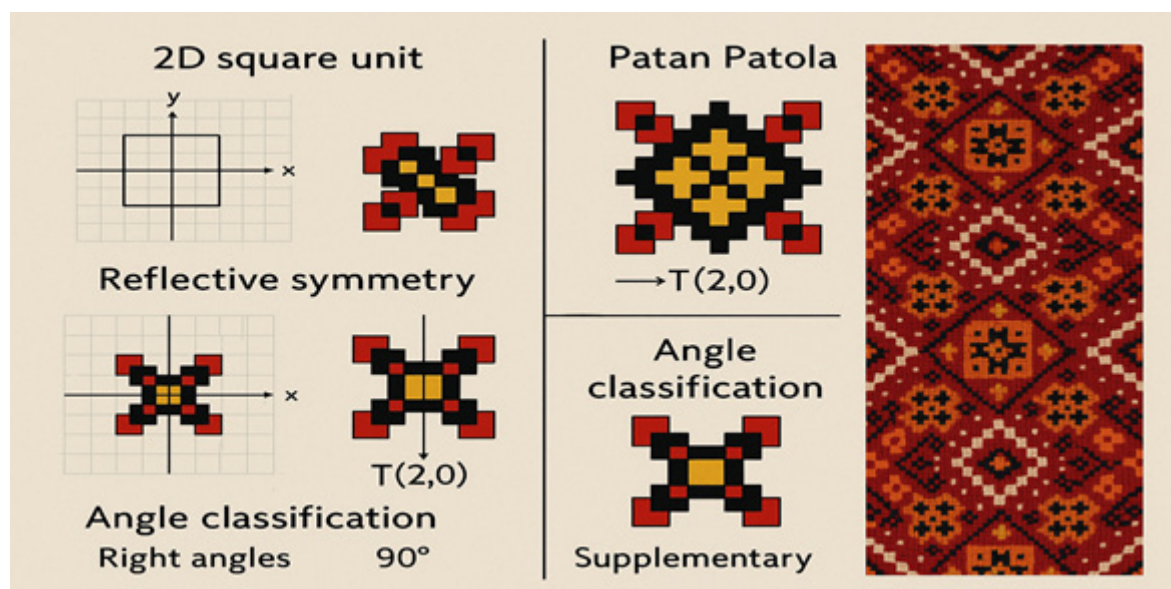
The Toda tribe, an indigenous community residing in the Nilgiri Hills of Tamil Nadu, is known for its rich cultural legacy and intricate handicrafts, particularly basket weaving. These Toda baskets (locally referred to as puttukuli) are traditionally woven using bamboo strips and cane, serving both utilitarian (e.g., grain storage, goods transport) and ritualistic purposes (Bahadur Subba et al., 2022; Gogoi et al., 2022). The craftsmanship involved reflects not only manual skill but also the Toda people's intimate relationship with their environment, spirituality, and communal

identity. The symbolic significance of these baskets is preserved through intergenerational transmission, making them a living artefact of the tribe's cultural epistemology (Rick, 2021).

Objective 3: To study the mathematical patterns such as symmetry, tessellation, and geometric transformation embedded in traditional Indian weaving, beadwork, and basketry.

Mathematical Patterns and Cultural Symmetry in Traditional Weaving

Ethnopedagogical Approach to Patola in Education



The square-based motifs in Patan Patola are not merely decorative elements but encode cultural cosmologies. Squares symbolize order, balance, and the sacred mandala structure seen in Jain and Hindu temples. The square tessellations of Patan Patola follow rigorous grid logic, which obeys the principle of Euclidean tessellation, allowing units to fill the plane without any untaken areas or the creation of unwanted overlaps. These square patterns may be said to possess translational symmetry, both in the x- and y-directions, and sometimes also rotational symmetry, about 90- and 180-degree angles

around important points of intersection. The coincidences of neighbouring edges and the shape repetitions indicate indigenous knowledge of isometries, that is, geometric transformations such as reflections, rotations, and translations in which the original shape is preserved without distortion, but artists describe these methods using the terminology of balance or mirroring.

In geometry, each unit can be approximated as a two-dimensional square of identical dimensions (e.g., 1 x 1 inch). In this area, lines at 450 angles, 900 angles, and perpendicular bisectors serve as secondary/

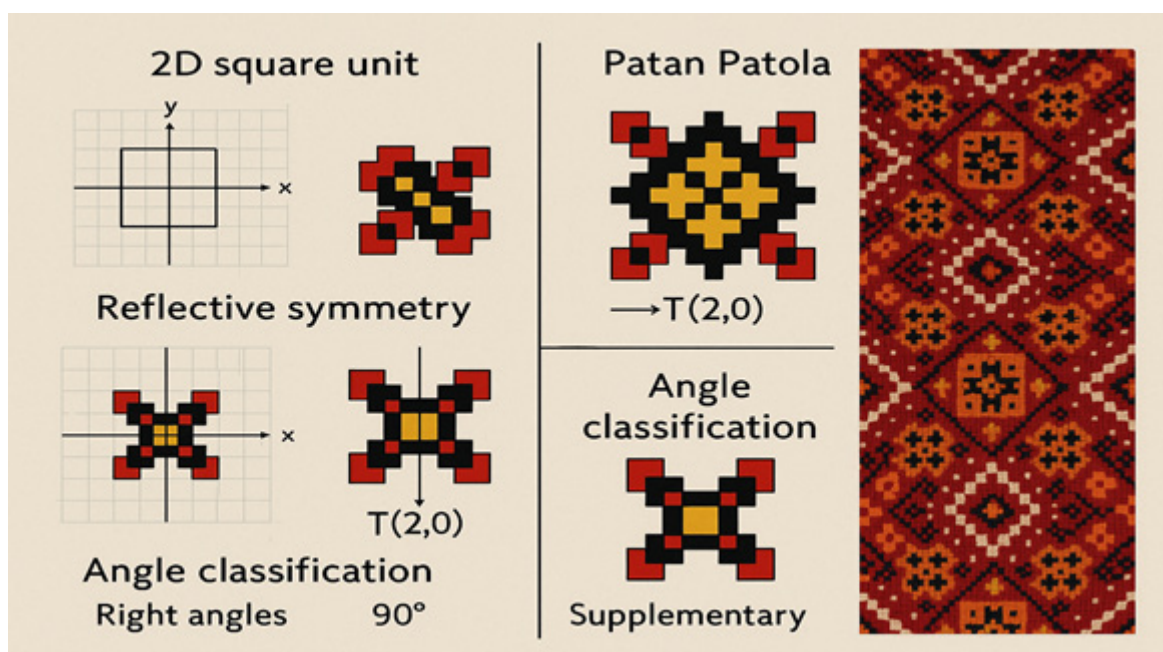
sub-motifs and create nested symmetry. It can be modelled digitally by plotting the configuration on coordinate planes or grid paper, on which symmetry axes and vectors of translation ($T(x, y)$) can be plotted and calculated.

Such analysis helps educators connect craft with formal mathematics:

- (a) Reflective symmetry $\rightarrow$ Mirror line = y-axis (vertical)
- (b) Translational symmetry $\rightarrow$ Vector = $T(2,0)$ (horizontal shift)
- (c) Angle classification $\rightarrow$ Right angles (90°), supplementary angles (180°), or congruent isosceles patterns.

By using Patola as a teaching tool, mathematics becomes more contextualized and culturally inclusive, especially for students with heritage connections to textile traditions. This not only improves engagement but also fosters epistemological pluralism – the idea that multiple valid ways exist to understand and represent mathematics (Rosa & Orey, 2011). Incorporating such rich, hands-on content aligns with UNESCO's goals for education rooted in local knowledge systems, enabling learners to appreciate mathematical reasoning in their own cultural surroundings.

Ethnopedagogical Approach to Kanchipuram Silk in Education



The triangular motifs in Kanchipuram sarees often represent 'gopuram' temple towers, signifying ascent and divine energy. These triangles are symmetrically aligned in alternating or mirror patterns along the borders and pallu, showcasing bilateral symmetry. In terms of tessellation, these repeated triangular units mirror concepts of polygonal tiling, and artisans carefully calculate proportional spacing to ensure

continuous flow across the weave, demonstrating spatial awareness and abstract reasoning embedded in cultural motifs. Triangles are structurally stable and commonly used in both architecture and textiles for their rigidity. In the Kanchipuram borders, this reinforces not only design continuity but also mirrors the gopuram's architectural integrity.

The triangle that Kanchipuram silk employs is often an isosceles triangle

(equal angles at the base) or is based on a scalene variant (unequal angles at the base), based on the region. The mighty visual flow and rigidity with the angle properties, which may comprise 300, 600,900 in many instances, are chosen to confirm the strong upward design and structural stability as the temples themselves changed their logic to the construction and point out the structural stability by means of the use of the triangles.

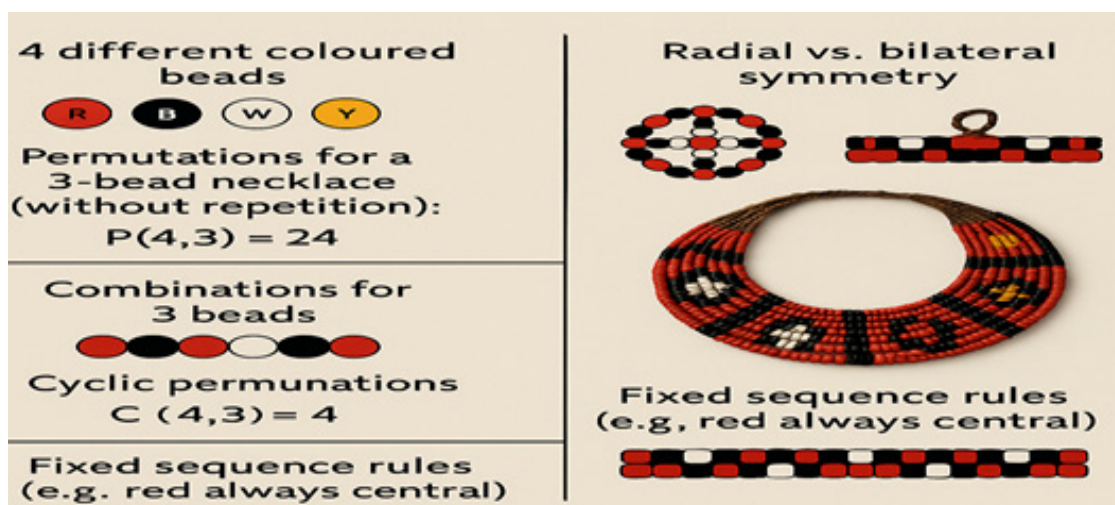
Mathematical concepts derived:

- Triangle interior angle sum = 180°
- Bilateral symmetry $\rightarrow$ line of reflection through triangle's height.
- Glide symmetry = $R + T(x, y)$, where R is reflection, T is translation.

Within a South Indian context of textile design, several motifs have a mathematical interest, as they are not only aesthetic elements, but also carriers of the encoded language of divine order, cosmic movement, and social ideals.

Mathematical Structures and Patterns in Beadwork

Ethnopedagogical Approach to Teaching through Beadwork



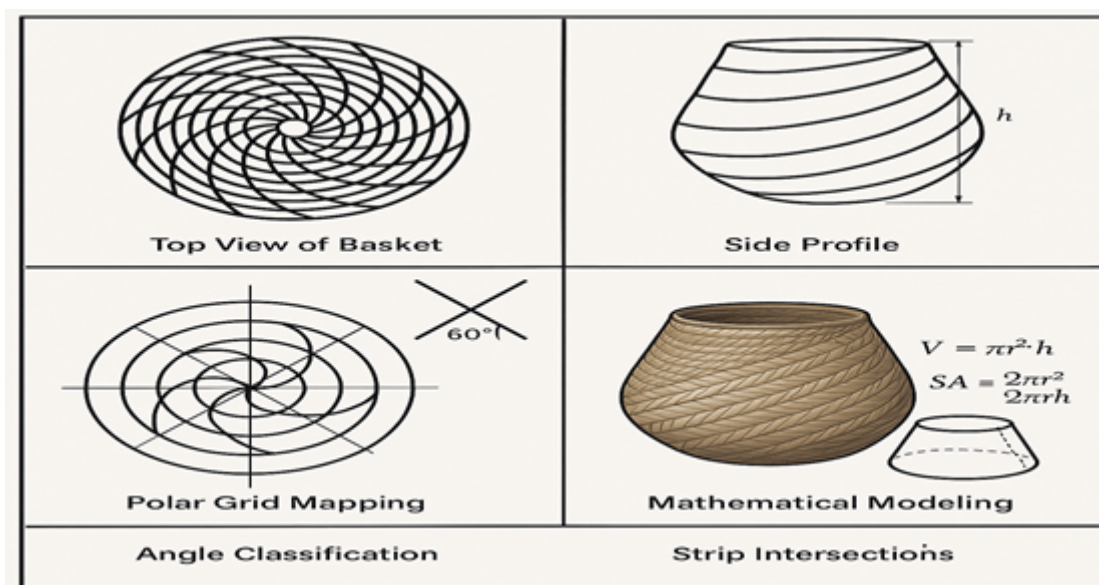
Naga beadwork shows the application of principles of combination to ornament design by using coloured beads in orderly combination. Cyclical patterns are also typical of traditional motifs, with such examples as the red, black, white, black, red, repeated pattern giving radial symmetry when wrapped around circular chokers and bilateral symmetry when wrapped along flat strips.

In view of fundamental combinatorics, when four differently coloured beads (R, B, W, Y) are at the disposal, the total number of the permutations of the necklace composed

of three beads with no repetitions is $24 = P(4,3)$. In the case of a combination, no matter the order, then it is $C(4,3) = 4$. The types of arrangements follow standard sequencing rules (usually due to tribal or symbolic meaning), showing the co-evolution of combinatorial reasoning and aesthetic tradition in Naga craftwork. Teachers may use such designs to explain the concepts of radial and bilateral symmetry and cyclic permutations, the pattern rules of mathematics, and cultural symbolism (such as the systematic use of red in the centre of a pattern).

The Geometric Principles and Concepts in Basketry

Ethnopedagogical Approach to Teaching with Toda Basket



The spiral and round shape of the Toda basket demonstrate an advanced understanding of radial geometry, rotation symmetries, and concentric growth plans, which are produced with no formal mathematical training at all. Unlike planar tessellations, Toda basketry functions on a cylindrical spatial system, where raw materials are stacked and interwoven in a three-dimensional spatial package to yield symmetric, balanced vessels. The radial nature of cane or bamboo strips creates a very logical pattern of repetition or order of sectors and rotatable sequencing, which is normally every sixty or ninety degrees or so, subject to design. The harmonious adjustment of curvature, strip distance, and angle rhythm witness an intuitive grasp of geometric constraints similar to Euclidean constructions, of which craftsmen often speak (understandably) of a sense of cycle, wholeness, or flow.

Geometrically, the viewing profile of the basket may be modelled by a two-dimensional circle on its top and a truncated cone or cylinder on its side. The alternating strips create angular sectors, which intersect to define repetitive angular sectors (e.g., six-fold or eight-fold

repetitive angular parts), thus defining visually nested circular motifs internally. The polar coordinates (r, θ) or the circular grids can be projected to show the radial layers and spiral increments, where angle sectors, the rotation centres, and continuity can be delineated and mathematically explained. This kind of study helps in making a meaningful use of Toda basketry in teaching mathematics:

Top View of a Basket

1. A circular diagram showing radial symmetry with lines at 60° or 90° intervals (Order-6 or Order-4 symmetry).
2. Overlaid spiral patterns or sector-based strip layout.

Side Profile Diagram

Depicting the basket as a truncated cone or cylinder, with labels for radius (r), height (h), and curved surface

Polar Grid Mapping

A polar coordinate plot showing how the spiral or radial strips align with (r, θ) positions.

Angle Classification Diagram

Close-up of strip intersections with labelled internal angles (60° , 90° , and supplementary pairs).

Mathematical Modelling

Simple geometric shapes overlaid on a 3D render of the basket, showing volume and surface area formulas like:

- $V = \pi r^2 h$
- $SA = 2\pi r^2 + 2\pi r h$

Taken together, these spatial constructions support a conception of geometric thought and prove that Toda weavers are quite natural students of 3-dimensional geometry and mathematical optimization. Their production, therefore, provides practical evidence on symmetry, structure, and measurement, and makes a good example of a cultural resource towards ethnographic mathematics-based teaching.

Major Findings from the Traditional Indian Art Form

Table 1: Summary of Mathematical and Ethno pedagogical Insights

Art Form	Mathematical Concepts	Ethno mathematical Approach (in Brief)	Example for Classroom Use
Patan Patola (Gujarat)	Tessellation, symmetry, grid geometry, translation, square-based repetition	Demonstrates precise spatial reasoning through double ikat weaving; ideal for teaching patterning and transformations.	Students design a tessellated pattern using square grids that mirror Patola motifs.
Kanchipuram Silk (Tamil Nadu)	Triangles, tessellation, symmetry (reflection, rotation), polygonal structures	Borders reflect sacred architecture and rhythmic geometric placement, useful in exploring types of triangles and symmetry.	Learners identify and classify triangle types used in saree borders and replicate border patterns.
Naga Beadwork (Northeast India)	Permutations, combinations, radial and bilateral symmetry, pattern repetition	Bead arrangement introduces combinatorics and pattern logic, a culturally responsive method to teach sequence and order.	Students use coloured beads to calculate and create different patterns using permutations.
Toda Basketry (Tamil Nadu)	Cylinder geometry, volume, surface area, circular symmetry, 3D visualization	Basket form supports teaching spatial dimensions and solid geometry; it connects abstract geometry to utilitarian design.	Learners model a Toda-style basket using paper cylinders and calculate surface area/ volume.

Table 2: Symmetry in Traditional Indian Fabric Arts

Art Form	Type of Symmetry	Mathematical Interpretation	Cultural Function
Patan Patola (Gujarat)	Reflectional (bilateral), Translational, Rotational	Symmetry across vertical and horizontal axes; grid tessellation with square motifs	Reflects order, harmony, and spiritual balance; used in double-sided patterns

Kanchipuram Silk (Tamil Nadu)	Reflectional, Rotational, Glide symmetry	Triangle motifs form mirrors and repeated patterns along fabric borders	Symbolic of temple architecture (Gopuram); denotes divine ascent and auspiciousness
Naga Beadwork (Northeast India)	Radial and Bilateral Symmetry	Patterns radiate from a central point or are mirrored along axes	Denotes tribal identity, status, and continuity; promotes visual equilibrium
Toda Basketry (Tamil Nadu)	Circular and Rotational Symmetry	Symmetry around the cylindrical axis; spiral formations in 3D	Practical for stability; signifies cyclicity and continuity in traditional use

Educational Implications

This study clearly demonstrates the transformative potential of incorporating traditional Indian crafts like Patan Patola weaving, Kanchipuram silk designs, Naga bead work, and Toda basketry into mathematics instruction. These cultural activities integrate mathematical ideas that can be applied in the classroom, such as symmetry, tessellation, permutation, and spatial reasoning. These practices are particularly significant because, when effectively connected to mathematics curricula, they form ethno pedagogical tools that simultaneously support the development of conceptual knowledge and promote respect for indigenous knowledge systems (Burkhardt, 2008; Firdaus & Nasution, 2023). According to D'Ambrosio (2006), mathematics can be characterized as a culturally situated practice with its historical, natural, and symbolic contingencies, which is consistent with the ethno mathematics approach. By incorporating them into the curriculum, these cultural forms provide learners with experiences that are both culturally and intellectually relevant while establishing indigenous forms of knowledge. Additionally, this plan stimulates linguistic and cultural diversity in mathematics instruction. A symbolic language with a specific set of cultural coding and mathematical illustrations is found in every cultural artefact. Examples include the symmetrical reasoning of Patola designs, the

temple directed connotations of Kanchipuram symbols, and the mathematical arrangements of Naga colour patterns. Acknowledging these various domains of knowledge allows students from many backgrounds to enter what may be perceived as a foreign and abstract field.

The masterful harnessing of the diversity of epistemologies also helps educators establish an inclusive classroom learning space wherein home cultures and native languages of the students are not marginalized; instead, used as resources that can intensify the student learning processes. This kind of pedagogical position not only improves mathematical discourse but also leads to identity affirmation, which induces learners to appreciate both their cultural background and their academic development (Rosa & Orey, 2011).

Furthermore, the paradigm encourages interdisciplinary engagement by rethinking mathematics as a medium that somehow links anthropology, history, art, and language, among other disciplines. To create cross-curricular literacy, a lesson about the radial symmetry of Naga beadwork, for instance, might be transformed into a language lesson about the colour names used in tribal languages or about the semiotics that the weaving patterns reflect.

Overall, incorporating conventional mathematical knowledge into the curriculum results in a pedagogical system that is pluralistic, inclusive, and culturally

sustainable. In addition to helping students grasp abstract concepts through context that is specific to them, it enables them to see mathematical complexity as a component of their own cultural identities.

Conclusion

Traditional Indian arts that most people know about, such as weaving, beading, and basketry, are not solely a result of visual phenomena alone, as they represent the traditional laws of mathematical thinking embedded in their culture, spirituality, and community. A careful analysis of the Patan Patola, Kanchipuram silk, Naga beadwork, and Toda basketwork has brought to light how mathematical ideas, such as viewing balance in terms of symmetry, tessellation, combinatorics, and space-positioning related sense, inform the cultural sensibility of these communities. This paper uses the theoretical input of D'Ambrosio (1985),

Knijnik (2002), Rosa and Orey (2011), and their comparative studies between Africa and Brazil to place ethno mathematics in the context of a decolonial pedagogical approach. Instead of considering such crafts as cultural oddities or symbolic representations of mathematics, the study considers them as plausible forms of

mathematical practices that challenge the power of the themes of Western abstraction. When incorporated into classroom learning, these arts lend authenticity and inclusivity to mathematics even as they respect and acknowledge indigenous knowledge systems. In this way, the classroom becomes a site of epistemological democracy in which students are able to explore mathematics from cultural, social, and imaginative angles. The next step should involve a study of the artisans themselves, through interviews in the field as well as a continuing comparison with other crafts and oral literature. Ethno mathematics is not only a discipline or an idea, as this paper purports, but it is a paradigm in the reshaping of education in a pluralistic, respectful, and empowering way.

This redefines ethno mathematics not as a preparation to school-based formal mathematics that should be absorbed before progressing to formal mathematics, but as an actual cultural epistemology. Through providing alternative formations of representing, conceiving, and applying mathematics, these traditional practices reveal a refined geometrical understanding of patterns of formation and abstraction that appear beyond the formalized contexts of education.

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पुस्तक समीक्षा

भाषा का बुनियादी ताना-बाना: एक संकलन

चयन व सम्पादन – रजनी द्विवेदी, हृदयकान्त दीवान, प्रकाशक – एकलव्य, भोपाल

दशरथ कुमार पारीक

यह संकलन भाषा को उसके सबसे गहरे और जटिल स्वरूप में समझने का एक प्रयास दिखता है। भाषा यहाँ केवल शब्दों, ध्वनियों या व्याकरणिक संरचनाओं का संग्रह नहीं, बल्कि मानव के संज्ञान, समाज, संस्कृति, अनुभव और सीखने की प्रक्रियाओं से गुंथी हुई एक जीवित व्यवस्था के रूप में उपस्थित होती है। प्रस्तुत संकलन के लेख इस तथ्य को अत्यंत स्पष्ट और विश्लेषणात्मक ढंग से सामने रखते हैं।

पहले खण्ड में भाषा की प्रकृति को उन उदाहरणों के साथ समझाया गया है जो मानव-भाषा की विशिष्टता और उसकी सृजनात्मक क्षमता को सहजता से उजागर करते हैं। दूसरे खण्ड में भाषा और विचार के परस्पर सम्बन्ध को इस प्रकार रेखांकित किया गया है कि पाठक समझ सके—सोच और भाषा का विकास साथ-साथ होता है। तीसरा खण्ड दिखाता है कि व्याकरण मूलतः भाषा में निहित प्राकृतिक नियमों की खोज है, और चौथा खण्ड भाषा के सामाजिक, राजनीतिक और ऐतिहासिक आयामों को ठोस संदर्भों सहित खोलता है।

मुझे विश्वास है कि यह संकलन पाठकों में भाषा को एक बहुस्तरीय, सजीव और मानवीय प्रक्रिया के रूप में देखने की दृष्टि विकसित करेगा। यह पुस्तक शोधार्थियों, शिक्षकों, विद्यार्थियों तथा भाषा में रुचि रखने वाले किसी भी पाठक के लिए नई अंतर्दृष्टियों के अवसर देने में बतौर एक उपक्रम

होगी। मैं संकलन के लेखों से जुड़े कुछ खास पक्ष यहां साझा कर रहा हूं।

भाषा को प्रायः हम बोलने-सुनने की एक सामान्य क्रिया मान लेते हैं—कुछ शब्द, कुछ वाक्य, और एक संवाद। परंतु थोड़ी गहराई में उतरते ही स्पष्ट हो जाता है कि भाषा महज एक माध्यम नहीं, बल्कि मानव होने की मूल शर्त है। “भाषा का बुनियादी ताना-बाना” इसी गहराई को सरल, वैज्ञानिक और समझने योग्य रूप में सामने रखता है।

यह संकलन उन सबके लिए अपरिहार्य है जो भाषा को केवल व्याकरण या पाठ्यपुस्तक के दायरे में नहीं, बल्कि मानव-मस्तिष्क, समाज, संस्कृति, विचार और सीखने की प्रक्रिया के संगम के रूप में देखना चाहते हैं। रजनी द्विवेदी और हृदय कान्त दीवान ने चयन, सम्पादन और प्रस्तुति—तीनों स्तरों पर जिस सूझ-बूझ का परिचय दिया है, वह इस कृति को विशिष्ट बनाता है।

भाषा की जटिलता का सहज उद्घाटन

संकलन का पहला खण्ड पाठक को भाषा की आंतरिक बनावट, उसके जैविक आधार और बोलने की अनगिनत प्रक्रियाओं से परिचित कराता है। भाषा बोलना कितना स्वाभाविक लगता है, और वास्तव में वह कितना जटिल है—इसे पुस्तक बड़े रोचक उदाहरणों से साबित करती है। ध्वनियों का मेल, वाक्यों की

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योजना, अनुमान, अर्थ-सृजन—सब एक साथ चलते हैं, ठीक उसी तरह जैसे कोई कुशल कलाकार अनेक क्रियाओं को एक साथ निभा लेता है। यह हिस्सा भाषा-विज्ञान से अनजान पाठक को भी सहज ही जटिल अवधारणाओं तक पहुँचा देता है। शिक्षक वर्ग अपनी विषय पैडागोजी में इसकी दृष्टि को समझने के साथ ही कुछ अभिनव प्रयोग करके देख सकता है।

भाषा और विचार—मनुष्य को गढ़ती हुई प्रक्रिया

दूसरा खण्ड इस संकलन की संकल्पनात्मक रूपरेखा को सबसे गहन स्तर पर व्यवस्थित और अर्थपूर्ण ढंग से प्रतिपादित करता है। इसमें बताया गया है कि भाषा केवल संप्रेषण का औजार नहीं, बल्कि सोचने, समझने और अपने अनुभवों को आकार देने की प्रणाली है। यह खण्ड मातृभाषा की भूमिका को अत्यंत संवेदनशीलता के साथ रेखांकित करता है—किस प्रकार बच्चे की सोच, अवधारणाएँ और आत्म-विश्वास उसकी अपनी भाषा में ही सबसे स्वाभाविक रूप से विकसित होते हैं।

भाषा और विचार के रिश्ते पर प्रस्तुत लेख पाठक को यह सोचने पर मजबूर करते हैं कि शब्द केवल नाम नहीं, बल्कि दुनिया को देखने के कोण हैं। पाठक महसूस करता है कि भाषा मानव-मस्तिष्क का विस्तार है—सोचने और समझने का अदृश्य ढाँचा।

व्याकरण—नियम नहीं, प्रकृति है

संकलन का तीसरा खण्ड उस बड़ी भ्रांति को तोड़ता है जिसमें व्याकरण को रटे जाने वाले नियमों का बोझ मान लिया जाता है। यहाँ व्याकरण को भाषा की स्वाभाविक प्रणाली, उसकी ‘अन्तर्निहित व्यवस्था’ की तरह समझाया गया है। बच्चे बिना पढ़ाए ही अपनी भाषा के नियम सीख लेते हैं—यह सत्य इस खण्ड में कई उदाहरणों और विश्लेषणों के माध्यम से स्पष्ट होता है। भाषा-शिक्षण के संदर्भ में यह दृष्टि अत्यंत महत्वपूर्ण है, क्योंकि यह शिक्षकों को यह समझ देती है कि व्याकरण को

सिखाना नहीं, बल्कि उजागर करना होता है। राष्ट्रीय शिक्षा नीति 2020 तथा एनसीएफ-स्कूली शिक्षा 2023 दोनों स्पष्ट करते हैं कि व्याकरण को भाषा से पृथक किसी नियम-पुस्तक की तरह नहीं, बल्कि अर्थ-निर्माण और संप्रेषण की वास्तविक प्रक्रियाओं के साथ एकीकृत रूप में पढ़ाया जाना चाहिए। नीति दस्तावेज़ बताते हैं कि बच्चे भाषा के पैटर्न स्वाभाविक प्रयोग के माध्यम से आत्मसात करते हैं; इसलिए व्याकरण-शिक्षण का उद्देश्य नियम थोपना नहीं, बल्कि प्रामाणिक भाषाई संदर्भों में नियमों को उभरने देना है। यह दृष्टिकोण भाषा-शिक्षण को यांत्रिक त्रुटि-शोधन के बजाय एक संज्ञानात्मक, विश्लेषणात्मक और प्रयोग-आधारित प्रक्रिया के रूप में स्थापित करता है।

भाषा और समाज—ताकत, पहचान और राजनीति

चौथा खण्ड भाषा को समाजशास्त्रीय नज़र से देखता है। कौन-सी भाषा ‘शुद्ध’ है? कौन-सी ‘श्रेष्ठ’? क्या बोली किसी भाषा का ‘कमतर’ रूप है?—इन सभी गहरे सवालों पर यह खण्ड स्थापित धारणाओं को चुनौती देता है। यहाँ भाषा को सत्ता, अवसर, सामाजिक प्रतिष्ठा और पहचान से जोड़कर देखा गया है।

यह हिस्सा विशेष रूप से भारतीय संदर्भ में महत्वपूर्ण है जहाँ भाषा, लिपि, बोली और मानकीकरण को लेकर कई तरह की धारणाएँ प्रचलित हैं। संकलन इन मिथकों को तथ्यपूर्ण तर्कों से तोड़ता है और पाठक को भाषा-विविधता का सम्मान करना सिखाता है।

संकलन की समग्र दृष्टि

“भाषा का बुनियादी ताना-बाना” केवल अध्यायों का समूह नहीं, बल्कि भाषा को गहराई से देखने की एक समग्र दृष्टि प्रदान करता है—

- भाषा एक जैविक क्षमता भी है,
- एक मानसिक प्रक्रिया भी,

- एक सांस्कृतिक संरचना भी,
- एक सामाजिक शक्ति भी,
- और शिक्षण-अधिगम का आधार भी।

पुस्तक का सबसे अभिन्न पक्ष यह है कि कठिन अवधारणाओं को सरल उदाहरणों और कहानियों के माध्यम से खोला गया है। लेखक और सम्पादक ने यह सुनिश्चित किया है कि भाषा-विज्ञान जैसी जटिल विधा भी शिक्षक, विद्यार्थी और आम पाठक के लिए सहज और उपयोगी हो सके।

यह संकलन उन सभी के लिए आवश्यक है जो भाषा को एक जीवित, गतिशील और मानव-निर्माण की प्रक्रिया मानते हैं—विशेषतः शिक्षकों, शोधार्थियों और भाषा-संघर्षों से जूझते समाजों के लिए।

यह पुस्तक केवल पढ़ने की सामग्री नहीं, बल्कि सोच, समझ और शिक्षण-व्यवहार को दिशा देने वाला एक महत्वपूर्ण मार्गदर्शक है।

NCERT JOURNALS PUBLICATION POLICY

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In case the manuscript is based on a case study, research problem, or project undertaken the submissions should range from 3000 to 8000 words. Notes, comments, or observations on policies should range from 3000 to 5000 words. Similarly, book reviews including abstract should range from 1500 to 2500 words. However, the exact details of the word limit for the concerned journal may be checked from the said journal's guidelines. The main manuscript file must not include name and affiliation of the author(s). Author(s) must provide a separate title page containing the manuscript title, names, affiliations, e-mail IDs and postal addresses of all the contributors. The manuscript and title page file must be submitted along with a covering letter containing the following undertaking:

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Sharma, P. (2023). Teaching for the time being: Teaching and teacher identity in low-fee private schools in semi-urban Delhi. *Contemporary Education Dialogue*, 20(2), 283-304. <https://doi.org/10.1177/097318492311724>

Veraksa, A., & Solovieva, Y. (Eds.). (2024). Learning mathematics by cultural-historical theory implementation: Understanding Vygotsky's approach. Springer.

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