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A STUDY OF MATHEMATICS ACHIEVEMENT FOR TRIBAL STUDENTS

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ABSTRACT:

This research paper explores the challenges faced by tribal students in achieving proficiency in mathematics and examines various interventions aimed at enhancing their mathematics achievement. The unique cultural, socio-economic, and geographical circumstances of tribal communities often contribute to disparities in educational outcomes, including mathematics performance. This paper discusses the role of cultural sensitivity, pedagogical strategies, community engagement, and policy initiatives in addressing these disparities. Through a comprehensive review of existing literature, this paper identifies promising practices and suggests future directions for research and policy to promote equitable mathematics achievement for tribal students.

KEYWORDS: Tribal students, mathematics achievement, cultural sensitivity, pedagogical strategies, community engagement, policy interventions, equity, education, indigenous knowledge.

INTRODUCTION

Mathematics is a universal language and a fundamental skill that plays a pivotal role in shaping academic, professional, and personal success. However, the attainment of mathematics proficiency is not evenly distributed among all segments of society. One particularly marginalized group facing significant challenges in this regard is tribal students, who belong to indigenous communities residing in various regions around the world. These communities, often characterized by their distinctive cultures, languages, and ways of life, face a range of obstacles that hinder their mathematics achievement. Tribal students' journey toward mathematics proficiency is marked by unique cultural, socio-economic, and geographical factors that intertwine to create both barriers and opportunities. The discrepancies in mathematics achievement between tribal and non-tribal students highlight the pressing need to explore and address the underlying issues that impede the educational progress of tribal communities. By delving into these challenges and investigating effective interventions, educators, policymakers, and researchers can collaboratively work towards ensuring equitable access to quality mathematics education for tribal students.

TRIBAL KNOWLEDGE SYSTEMS

After independence, policies have been revised several times in order to make education relevant for tribal children. Several print materials (though of doubtful quality) were developed by the State Councils of Educational Research and Training (SCERT) and Tribal Research Institutes (TRIs) in the tribal languages for primary classes, which were used only occasionally as supplementary readers in

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the schools. The culture and everyday cognitions of tribal children hardly influenced the main readers, i e, textbooks. In fact, the textbooks and the classroom transactions continue to be predominantly monocultural and also monolingual in all subject areas. Among different subject areas, mathematics teaching suffered most in tribal area schools because the tribal children come to school with a very different number system (which is not often linked to written symbols). They use different heuristics and algorithms to solve day-to-day mathematical problems. In school, they are fed mercilessly, with a series of written symbols, notations and formulas without any effort at linking these to their past experiences. In fact, the acceptance of the idea that mathematical knowledge is part of the culture has been fairly half-hearted among the policy-makers and textbook writers. Though anthropological and sociohistorical research strengthens this view by revealing more and more of the rich tapestry of mathematical knowledge existing in hundreds of folk cultures around the world, there is a kind of in-built resistance to linking mathematics teaching to community knowledge. Mathematical ideas develop everywhere because people may live in different cultures, but they do similar things like arguing, comparing, searching, working to find food, enjoying themselves, fighting with each other and also carrying out other economic and commercial activities [Dorfler 2000]. Six operations which people engage in across all cultures are counting, measuring, designing, locating, playing and explaining [Dorfler 2000]. These activities involve an enormous amount of mathematics. In fact mathematical understanding is culturally conditioned and created across cultural contexts. However, unlike in many written cultures, in tribal cultures (most of which are oral) mathematics and science practices are not recorded, formalised and passed on beyond the context of their immediate usefulness. For this reason, this body of knowledge is not recognised by the academia as a structured body of knowledge, but rather remains a set of ad hoc practices. The other reason for which such potential mathematical knowledge is not used in the school is our fixation with modern mathematics and the Eurocentric approach. In fact, it is now time to acknowledge that mathematics is not just about sums, fractions and equations. In recent years, the feeling of exasperation at being entangled in such a narrow definition of mathematics has been noticed among pedagogues and textbook writers. But the fear of a grand paradigmatic shift that probably implied a larger societal change in the area of power relations among cultural groups kept the bottom line defined. The bottom line here is the ubiquitous “child” and the use of those examples from society that are familiar to the majority of children but are “believed” to be shared by, or are at least familiar to, the children of minority groups.

The beliefs that are held privately by teachers and parents from the majority communities that the children of majority groups may not gain much from the discussion of mathematics by minority groups have further reinforced existing classroom practices. The NCF’s (2000)4 submission that the multi-cultural complexion of society demands a multi-cultural approach to mathematics however remains at the level of rhetoric especially when actually translated into development of print materials like textbooks, activities, etc, and pedagogic practices. According to this ethos, children should have been introduced to different number systems and also several measuring and counting devices used by the various cultural groups in this country. But the common fear across the masses – both common man and professionals – that such an approach may confuse the children and increase the cognitive burden on them brought the pendulum back to its original position [for a detailed analysis of NCF 2000, see Panda 2004b]. The philosophic thrust of mathematics education as spelt out in NCF 2000 is aimed towards encouraging students to explore maths concepts and solve problems related to their everyday experiences. But the NCF 2000 document is silent on how to build symbolic and axiomatic knowledge on that foundation. Probably, instead of prescribing the methods and ways of doing it, the decision was left to the implementation agencies such as textbook writers and teacher trainers. This should have been ideal in a complex multicultural society like ours where each district, even the block, is unique in multicultural composition of its population. But in the given circumstances of the teacher's negative attitude towards these knowledge systems as valid sources of knowledge and textbooks mirroring the dominant class's values, perceptions and cultures, very little could be expected from the teachers, teacher trainers and textbook writers. Moreover, the existing attitude towards indigenous knowledge systems was grossly misconceived and patronising. In last 50 odd years, we have only satisfied ourselves by mentioning them in policy documents or in our reactions to existing policy documents, that too in a sporadic manner. Even today, the emphasis in school mathematics is entirely on conceptual understanding, application of concepts, algorithmic performance, problem solving processes, etc. The attitudinal and other affective aspects of mathematics learning are to a large extent undermined; leave aside the inclusion of the everyday mathematical cognitions of the tribals in textbooks and classroom transactions.

Mathematics and NCF 2005: A Critique

The recently formulated NCF 2005 appears to be philosophically a much more consistent document than NCF 2000. The new curriculum framework begins with an overview of our past experiences with curriculum and sets out new goals for education in the first chapter. The first chapter discusses the social context of education and the guiding principles of the new national curriculum framework. The second chapter discusses threadbare the basic assumptions the NCF 2005 makes about the learner whose role has been rightly described as active, who is rooted in a specific cultural context and is a coconstructor of knowledge. It deals with most fundamental issues, like what is knowledge and understanding in general; how children's knowledge is integrally linked to local knowledge5 and how knowledge is re-created, etc. It acknowledges local knowledge traditions and argues for making the experiences of the sociocultural world a part of the curriculum. In various places, the scientific knowledge embedded in the local cultures is discussed to establish a link between children's knowledge base as well as the natural learning processes.7 In each of these sections, various local knowledge traditions and their curricular and pedagogic relevance in the area of science teaching, social science teaching and teaching of ecology, etc, are discussed. But, local mathematical knowledge systems and the process of mathematics learning in communities do not find equivalent emphasis even once in the first two chapters. Therefore, the first impression one gets after going through the first two chapters is that the underlying assumptions of mathematics learning has not probably moved far from the pre-Kuhnian8 position that mathematics does not have much to do with communities, its knowledge and value systems. The following paragraph taken from NCF 2005 dealing with "how mathematics is generally learnt" reinforces this doubt: Mathematics has its own distinctive concepts, such as prime number, square root, fraction, integral and function. It also has its own validation procedure, namely, a step-by-step demonstration of the necessity of what is to be established. The validation procedure of mathematics is never empirical, never based on observation of the world or on experiment, but are (sic) demonstrations internal to the system specified by the appropriate set of axioms and definitions (paragraph 2.5.3. Forms of Understanding, NCF 2005). This paragraph clearly provides the perspective of modern mathematics taught in present day schools, which is to a large extent western in origin. It takes a particular position not only in terms of what constitutes mathematics, but also in terms of mathematics as an ontological system, which is of modern western mathematics. Western mathematics is axiomatic whereas Indian mathematics found in the everyday practices of many cultural groups in India is not. Young Indian children come to school with mathematical knowledge rooted in the epistemic practices of their community. Such knowledge systems are not axiomatic, instead they are governed by the societal norms, values and also world views along with some pure mathematical considerations. Such fusion of societal or extra-mathematical considerations and the logico-deductive nature of this science are unique to oral traditions. Disregarding this knowledge system and the forms of knowing rooted in a particular epistemic practice of a community means disregarding children's past experiences and knowledge systems. From a pure academic and conceptual point of view, there is nothing wrong with the NCF paragraph cited above. But from a cultural perspective, the paragraph seems to have taken an epistemic position that is not ours.

Vision for School Maths

This problem is also evident in the way the major concerns and the vision for school mathematics have been spelt out in NCF 2005. The two major concerns of mathematics curriculum spelt out in the document are as follows: The twin concerns of the mathematics curriculum are: what can mathematics education do to engage the mind of every student, and how can it strengthen the students' resources? (p 38). None of the sections dealing with mathematics has attempted to define "students' resources". In the absence of clarity, one does not know whether the resources here refer to cognitive resources, like intradiscursive resources built on the basis of a set of axioms and logic, or to those intra discursive resources built on the basis of a few as-if assumptions9 people make in the community about a mathematical object and therefore mathematical reality. A closer scrutiny of the vision statements made in the document on school mathematics further reinforces this apprehension.

- Children learn to enjoy mathematics rather than fear it.
- Children learn important mathematics: mathematics is more than formulas and mechanical procedures.
- Children see mathematics as something to talk about, to communicate, to discuss among themselves, to work together on.
- Children pose and solve meaningful problems.
- Children use abstractions to perceive relationships, to see structure, to reason out things, to argue the truth or the falsity of the situation.
- Children understand basic structure of mathematics: arithmetic, algebra, geometry and trigonometry, the basic content areas of school mathematics, all offer a methodology for abstraction, structuration and generalisation.
- Teachers engage every child in class with the conviction that everyone can learn mathematics (p 38, NCF 2005.)

The vision here does not mention the specific needs of numerous cultural groups in India who use different kinds of number systems (many of which exist as oral practices) and algorithms, and speak different languages. Nor does it mention how these can inform the classroom processes in multicultural schools in India. In fact, universal statements like these tend to push away folk mathematics from any kind of academic discourse limiting the scope of its inclusion in the curriculum. Is the omission of a cultural perspective in the beginning inadvertent or intentional? A closer look at the document seems to affirm the latter and not the former.

CONCLUSION

Many of us who argue for culturalising mathematics pedagogy do so with a belief that such an approach is necessary not only for protecting the self-esteem of tribal children but also for giving them a meaningful and culturally valued education. Indulgence in mathematical conventions and ways of speaking is partly an emotional willingness. The learners, be it tribal children or any other, must indulge in mathematical discourse willingly and this participation cannot be forced on them by persuasion or cogent arguments. Presently, the mathematics curriculum, syllabus and the textbooks do not represent tribal culture, their value system and knowledge. As a result, tribal children are forced to participate in a convention of mathematical discourse, which they neither own nor remotely identify with [Panda 2004a]. This explains the research findings that the tribal children find mathematics textbooks and pedagogy culturally cold and barren and gradually lose interest in mathematics. Therefore, speaking from an equity point of view, the new curriculum framework needs to identify some of these rough patches,

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which unless crossed or filled up may fail to address the needs of the tribal children. The document could be more emphatic and also explicit on the epistemological frame of mathematics curriculum. Such a frame should take into account peoples' mathematics and its ontological aspects as well. Beside this, the document needs to go one step further by suggesting how to build the symbolic and axiomatic knowledge on the everyday knowledge of tribal children.

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