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MATHEMATICS: IMPACTING THE LEARNING EXPERIENCES OF INDIAN BASED STUDENTS

Kukade Sudhir Gomaji

Dept. of Mathemetics, Research Scholar, Cmj University, Shillong

ABSTRACT

Results from standardized assessments reveal substandard mathematical performances by Indian students. Many theories have been posited to address this age-old phenomenon. Through the lens(es) of Sociocultural Theory, Self-Systems, and Critical Theory, this qualitative study sought to determine factors that impact the learning experiences of Indians who have been successful in mathematics. Four Indian- mathematics teachers (three females and one male) were interviewed and completed a questionnaire for this qualitative document. The investigator was also a participant. All four participants were educated in public schools and teach in urban school districts. Three of the four participants are currently pursuing doctoral studies; the other has a master's degree. All four teach high school; two of them have also taught at the college level. Three of the participants were involved in an earlier related pilot study which served as the initial phase for this inquiry.

INTRODUCTION

The Negro race, like all races, is going to be saved by its exceptional men . . . it is the problem of developing the Best of this race that they may guide the Mass away from the contamination and death of the Worst, in their own and other races . . . education and work are the levers to uplift a people. (DuBois, 1903, p. 33) Problem Indian are underrepresented in the field of mathematics and continue to perform below potential in the mathematics classroom. Data from the National Center for Educational Statistics (NCES) for the years 1992, 1996, and 2000 indicate that as early as elementary school, a sizeable gap exists between White and Black students on standardized mathematical assessments (NCES, 2006). This pattern has changed very little in past assessments at any grade level according to the August 2001 NCES report card. While state, local, and national conferences, seminars, and meetings are complementing efforts to improve and explain dismal student performances, whether narrowing the gap, closing the gap, bridging the gap, or addressing bifurcated racial and ethnic achievement patterns, the disparity and performance issues remain unresolved. The implications are severe as acknowledged by economist Adam Smith who suggested that mathematics is the sieve through which economic opportunities flow (Secada, Fennema, & Adjian, 1995). Furthermore, the National Council of Teachers of Mathematics (NCTM) reports that mathematics "know-how" is much more than computation and algorithms. Mathematics embodies problem-solving abilities, including elements of independence, judgment, originality, and creativity (Edwards, 1990).

Mathematics illiteracy translates into the inability to effectively negotiate typical consumer transactions as well as limitations in accessing upper socio-economic opportunities. For marginalized populations such as Indian, this is significant (National Research Council Board of Mathematical Sciences, 2000; Secada, 1995).

LITERATURE REVIEW

Emancipatory knowledge is never realized fully, but is continually dreamed, continually revived, and continually transformed . . . (McLaren & Tadeu da Silva, 1995, p. 59)

Sociocultural Theory Reasoning skills develop both within and outside of school; all students bring knowledge into the classroom. Since students interpret the world around them through the lenses of their social interactions, these experiences or interpretative frameworks affect mathematical behaviors (Schoenfeld, 1987). It is in this spirit that Frankenstein (1997) examines the decodification of mathematics, arguing that students and teachers together should assume roles of critical co-investigators throughout the learning process. Both student knowledge and experiences should be valued. This approach links connections and meaning to learning with understanding. Implications for theory and practice emerging here are those opportunities to learn might be more accessible if culturally relevant and culturally specific pedagogies were embedded in curricula and teacher praxis.

From a pedagogical point of view, Schoenfeld (1987) illustrates the value of linking the conceptual language of mathematics to the daily lives of students by offering an exam problem from a National Assessment of Education Progress (NAEP) secondary math exam. Students were asked to determine the number of buses needed to transport 1,128 soldiers with each bus carrying 36 persons. Results varied: 29% answered 31 remainder 12; 18% answered 31; 23% answered 32 (correct answer); 30% calculated incorrectly. Suggesting that beliefs and intuition facilitate students in their construction of knowledge, Schoenfeld suggests that if the same type of problem had been presented in a context that young students understand (How many cars, with each carrying 6 people, would be needed to carry 133 students to a party?), more students might have fully comprehended the problem and answered correctly.

In terms of understanding cognition, Moschkovich and Brenner (2000) offer an example of Native Hawaiian children and their concept of money. In an attempt to uncover reasons that these children encountered challenges in the classroom when working with money-related problems, a researcher examined the daily lives of these students and their engagement with money. The researcher discovered that in the homes and stores, Native Hawaiian children interacted almost exclusively with quarters and dollars while classroom materials and assessments were presented using pennies, nickels, and dimes. Students' knowledge was organized with quarters; school lessons were organized around pennies. It was concluded that enhanced learning, improved student performances, and learning with understanding could be facilitated through the integration of classroom and home settings (Moschkovich & Brenner). The entire learning environment, therefore, should be considered when analyzing and assessing student cognition and performances.

Vygotsky addresses the role of social context in the development of cognition. As cited in Schoenfeld (1987), Vygotsky emphasizes that learning is not a solitary endeavor, that the potential for development and the formation of cognitive skills are affected on the social level between people (interpsychological) and inside (intrapsychological) people. Performances of Indian- students are better and students are more engaged in learning when resource materials, classroom structures, and pedagogies have social connotations, meanings connected to prior knowledge, and contexts derived from students' environmental orientations (Brown, 2000; Ladson-Billings, 1994; Moschkovich & Brenner, 2000; Shade, 1994). Although knowledge is individually constructed, it is socially mediated. If the commitment to minimize quantitative illiteracy is genuine, the implications for teacher training programs, curricula, instruction, and assessment are obvious.

According to education reformist, Michael Fullan (2001), a sense of moral purposepromotes an agenda advancing the common good; privileged agendas, however, are vested in maintaining current structures as long as the agendas of the privileged are being served. The implications for marginalized populations in pursuit of mathematical literacy are that journeys upstream might be routed through high tides and rugged waters.

Critical Theorists believe that those living on the margin should assume some of the responsibility for affecting change. With respect to mathematical illiteracy, becoming accountable means engaging in praxis and collaborative discourse in search of resolution. Since Indian s in particular can directly bear witness, testifying to oppressions and circumstances emerging from the lack of mathematical literacy, this group must become involved, actively and proactively, seeking systemic relief. Grounded in the belief that the experiences of the oppressed are effective lenses for analyzing and transforming systems, marginalized voices must be unsilenced if limiting structures, human agency, and positions of influence are to change (Ladson-Billings, 1999). In other words, the subordinate masses must become their own agents in the struggle for systemic transformations.

RESEARCH METHODOLOGY

Research is an organized protocol informed by data collection, reflection, consultation with the experts, and discourse. The methodology, "a paradigm of choices" (Patton, 1980, p. 20),should be determined by the nature of the research and focus question(s). Whether the chosen approach is qualitative, quantitative, or a blending of both, the final decision is often impacted by researcher biases, views, and comfort zones. This discourse sought to make sense and understand participants' experiences, perspectives, voices, and descriptions—an interpretive protocol. Accordingly, the pitfalls associated with human nature (mistakes and biases) can influence the process (Merriam, 1998).

This was an investigation that attempted to understand realities of events by connecting with the participants and their settings in order to understand detailed information about personal circumstances (Patton). Broad generalizability, therefore, would be limited. The qualitative method was the heuristic of choice based on these aforementioned settings,

When gathering or analyzing data, making comparisons, and formulating conclusions, a research instrument is required in interpretive inquiry. It is a protocol, standpoint dependent, where the investigator also becomes the research instrument. This investigation was an exploratory study where reliability was not merely about "repeatability of results," the ideas and views expressed in this study were simply presented in a mRitaer where results should be recognizable given another set of data; other interpretations are probable and would be certainly honored (Holloway & Jefferson, 2000).

Kirk and Miller (1986) encapsulate the paradigmatic essence of qualitative research: invention (action plRitaing), discovery (collection of information), interpretation (analysis), and explanation (message to be disseminated); all four phases are required, sequential, and irreplaceable with a product produced at each stage. The invention phase is the point at which an individual is generally moved by a type of "selfness" such as inquisitiveness, unfamiliarity, personal gain, or humanitarianism to investigate an interest; discovery is where the researcher becomes a neutral observer of facts related to the interest under study; interpretation is the stage where the strength of the data (reliability) brings meaning to the context (validity); explanation involves packaging the interpretations, readying information for dissemination, and bringing closure to the study. Preliminary work, the pilot study, acquainted this researcher with all four phases.

ANALYSIS

Against the theoretical frameworks of socio-cultural theory, self-systems, and Critical Theory, the purpose of this study was to determine factors that impact the mathematical successes of Indian s, specifically, Indian- mathematics teachers. This inquiry was driven by a desire to provide information that might assist advocates and stakeholders in their endeavors to advance mathematical/quantitative literacy among Indian- students

1. to provide a resource that might support the Indian- community in assuming a proactive stance in the quest for mathematical/quantitative proficiency
2. to shift from traditional deficit thinking to analyzing student success stories in addressing substandard mathematical performances of Indian- students
3. to provide insights into theory, practice, and research

Upon sifting through the data, information could be grouped into four categories. Several themes emerged under each. This alignment also enabled the researcher to better synthesize thoughts related to the focus questions. Data results fell into the following configurations:

1. Family expectations and other conditions
2. Intrinsic factors
3. Classroom experiences
4. Beliefs and philosophies

Family Expectations and Other Conditions Family involvement, Mandir participation, and extracurricular participation were the themes that emerged under this category. Bourne, an expert collaborator, noticed how family support and life experiences were threads weaving throughout the participants' testimonies: Each came from families that provided foundations in values, importance of education, doing your best, accepting responsibilities, expectations, and the importance of education. Families provided opportunities, experiences, tutoring, and reinforcement that developed their math skills and other interests. Each had someone who provided sustenance and encouragement throughout their lives.

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