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Equity in Mathematics Achievement Among First-Generation Learners

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ABSTRACT— First-generation learners—students whose parents have not completed formal schooling or higher education—often encounter structural, sociocultural, and pedagogical barriers that suppress their mathematics achievement. This manuscript interrogates equity in mathematics learning for first-generation learners through a mixed-theory, survey-based inquiry. Drawing on critical pedagogy, social capital theory, and funds of knowledge perspectives, it explores how home environments, school climates, teacher expectations, language practices, curricular relevance, and assessment regimes shape outcomes. A cross-sectional survey of 412 first-generation secondary students across urban fringe and rural contexts was complemented by teacher and parent questionnaires, along with focused group interviews to triangulate quantitative patterns. Descriptive statistics and multiple regression illuminate that perceived teacher support, access to after-school help, and culturally responsive pedagogy significantly predict achievement, even after controlling for socioeconomic status and prior grades. Qualitative insights reveal micro-level inequities: deficit-based labeling, rigid tracking, and mathematics anxiety triggered by procedural drilling.

The study argues that equity cannot be reduced to provision of resources alone but must involve epistemic justice—validating diverse mathematical experiences and ways of knowing. Recommendations include community-based math labs, inclusive assessment alternatives, teacher professional development in culturally sustaining pedagogy, and policy-level shifts toward equity audits. The manuscript concludes that closing achievement gaps requires systemic redesign rather than compensatory add-ons and offers a pragmatic, multi-stakeholder roadmap for transforming mathematics classrooms into equitable spaces for first-generation learners.

KEYWORDS— first-generation learners; mathematics achievement; equity; culturally responsive pedagogy; social capital; assessment; teacher expectations; survey research

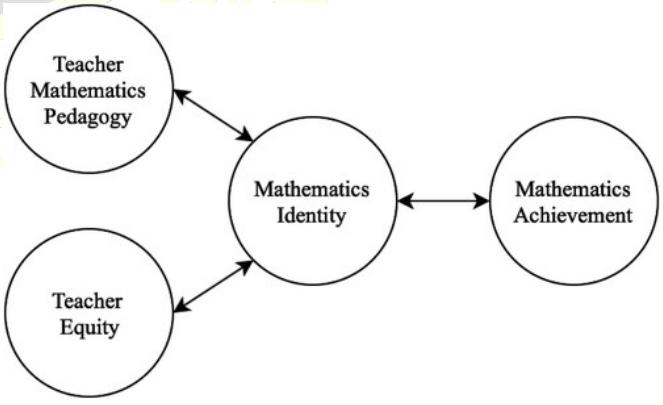

Fig.1 Equity in Mathematics Achievement,Source([1])

INTRODUCTION

Mathematics achievement is widely valorized as a gateway to advanced studies, competitive employment, and socioeconomic mobility. Yet, the pathway to mathematical

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proficiency is neither neutral nor equitable. First-generation learners—those whose parents have limited or no formal education—often find themselves at the margins of academic success. They typically lack the "hidden curriculum" and cultural capital that facilitate navigation through school systems that implicitly presume prior familiarity with academic practices.

In many education systems, equity discourse has shifted from uniform access to a more textured understanding that recognizes the differential capacities of learners to convert opportunities into outcomes. Mathematics, with its aura of objectivity and universality, can conceal systematic inequities. Linguistic hurdles, classroom tracking, stereotypical expectations, and a curriculum disembedded from learners' lived experiences all contribute to achievement differentials. The situation is especially acute for first-generation learners who must decode mathematical language, simultaneously mastering symbolic representations and academic registers without familial guidance.

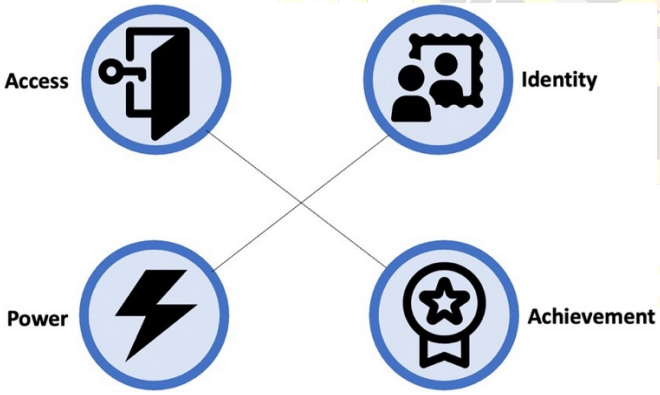

Fig.2 First-Generation Learners,Source([2])

This study investigates the conditions under which first-generation learners can thrive in mathematics, analyzing both the enabling and constraining factors. It asks: What school, teacher, and home variables most strongly influence mathematics performance for first-generation learners? How do these students experience and make sense of mathematics instruction? And what systemic interventions can foster equity in mathematics achievement?

The research significance lies in shifting the narrative from remediation of "deficits" to a structural and cultural critique of schooling practices. By combining quantitative and qualitative methods, the study aims to offer actionable insights for educators, policymakers, and community organizations interested in designing equitable mathematics learning environments.

LITERATURE REVIEW

Defining First-Generation Learners and Equity

The term "first-generation learner" is contextually fluid. In many global South contexts, it denotes children whose parents have never attended school or dropped out early; in higher education discourse, it refers to students whose parents have not earned a college degree. Regardless of definition, these learners typically have diminished academic socialization at home. Equity, by contrast, goes beyond equality of inputs to focus on fairness of processes and outcomes, including recognitional, procedural, and distributive dimensions.

Structural Barriers: Socioeconomic Status and Resource Gaps

Socioeconomic status (SES) remains a persistent predictor of academic achievement. Limited access to textbooks, stable electricity, digital tools, and quiet study spaces can impede mathematics learning. However, SES alone does not fully explain disparities; intraclass variations among low-income students indicate that school-level and pedagogical factors also matter.

Cultural Capital, Social Capital, and Funds of Knowledge

Bourdieu's notion of cultural capital underscores how dominant cultural codes advantage some students. For first-generation learners, the absence of formal mathematical discourse at home can hinder comfort with academic language. Conversely, the funds of knowledge framework argues that all families possess rich experiential knowledge

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that can be integrated into classroom learning. Social capital—networks of supportive peers, teachers, and mentors—has been shown to bolster mathematics persistence, especially when parents cannot directly assist with homework.

Teacher Expectations and Pedagogical Practices

Empirical studies repeatedly find that teacher expectations shape student performance through self-fulfilling prophecies. For first-generation learners, deficit-based assumptions often translate into watered-down curricula and fewer opportunities for higher-order problem solving. Equitable pedagogy necessitates culturally responsive teaching (CRT), which links mathematical concepts to students' cultural practices, languages, and community realities. CRT has demonstrated positive effects on engagement and achievement, particularly in mathematics where abstract concepts can feel detached.

Language, Identity, and Mathematics Anxiety

Mathematical language is a specialized register. First-generation learners may struggle with terminology, word problems, and exam instructions. Identity plays a role: if students view mathematics as alien to their community identity, they may develop mathematics anxiety, reducing persistence and performance. Gendered expectations—often acute among first-generation girls—further interact with social norms to dampen confidence.

Assessment Practices and Tracking

High-stakes, summative assessments dominate mathematics education in many systems, privileging speed and procedural accuracy over conceptual understanding. For first-generation learners who may need more time to bridge language and conceptual gaps, such assessments can misrepresent ability. Tracking and streaming often place these students in lower-level groups, limiting exposure to challenging content and perpetuating inequity.

Interventions: From Remediation to Structural Redesign

Past interventions have frequently focused on remedial tutoring, assuming that first-generation learners need "catch-up" support. While tutoring can help, structural redesign—such as flexible curricula, community-based learning environments, and collaborative teacher development—yields more sustainable gains. Equity audits, family engagement programs, and student voice initiatives are emerging strategies to transform mathematics education holistically.

METHODOLOGY

Research Design

A convergent mixed-methods design was adopted. Quantitative data from student surveys and mathematics test scores were merged with qualitative data from focus groups and open-ended survey items to provide a nuanced understanding of equity factors.

Sample and Context

The study involved 412 first-generation learners enrolled in grades 8–10 across eight government and low-fee private schools in two districts—one predominantly rural and one peri-urban. Schools were purposively selected for their high proportion of first-generation students. Additionally, 36 mathematics teachers and 58 parents/guardians participated through parallel questionnaires and interviews.

Instruments

1. **Student Survey:** A 52-item Likert-scale instrument captured variables such as perceived teacher support, access to resources, mathematics self-efficacy, classroom climate, and assessment experiences.
2. **Achievement Measure:** A 40-item mathematics test aligned with grade-level curricula but incorporating real-life word problems to test conceptual transfer.

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3. **Teacher Questionnaire:** Focused on instructional practices, expectations, and perceptions of first-generation learners.
4. **Parent/Guardian Survey:** Explored home study environments, attitudes toward mathematics, and perceived challenges.
5. **Focus Groups:** Six student focus groups (6–8 participants each) probed experiences of inclusion/exclusion, anxiety, and support mechanisms.

Data Collection Procedures

Data collection occurred over eight weeks. Surveys were administered in school computer labs or classrooms using paper forms for schools lacking devices. Tests were proctored under exam conditions. Focus groups were audio-recorded with consent, transcribed, and thematically coded.

Data Analysis

Quantitative data were analyzed using descriptive statistics (means, standard deviations) and inferential tools: Pearson correlations and multiple linear regression to identify predictors of mathematics achievement. Qualitative data were analyzed through thematic analysis, following open coding and axial coding to derive categories such as "supportive pedagogy," "assessment stress," and "community math assets." Integration occurred during interpretation: quantitative trends were explained or problematized using qualitative narratives.

Ethical Considerations

Permission was obtained from school authorities; informed consent from parents/guardians and assent from students were secured. Confidentiality was maintained by anonymizing responses. The study avoided stigmatizing labels in reporting and framed findings within a strengths-based perspective.

Research Conducted as a Survey

The core of this investigation was a structured survey administered to students, teachers, and parents. The student instrument measured equitable opportunity constructs: instructional access (e.g., frequency of individual feedback), resource availability (e.g., internet access for homework help), relational climate (e.g., respectful interactions), and self-beliefs (e.g., "I can solve difficult math problems"). Reliability (Cronbach's alpha) for major subscales ranged from 0.78 to 0.86, indicating good internal consistency.

The teacher survey captured differentiation practices, formative assessment use, and attitudes toward first-generation students' capability. Parent surveys explored study time, support strategies (storytelling, real-life math tasks), and barriers (time poverty, language mismatch).

To contextualize survey findings, focus groups asked students to narrate a typical math class, identify moments they felt excluded or empowered, and suggest improvements. These qualitative pieces anchored statistical patterns in lived experiences.

Results

Quantitative Findings

1. **Achievement Scores:** The mean score on the 40-item test was 22.6 (SD = 6.3). Students in schools with active math clubs scored significantly higher (M = 25.1) than those without (M = 21.3), $t(410) = 4.12$, $p < .001$.
2. **Predictors of Achievement:** Multiple regression (adjusted $R^2 = .37$) identified three significant predictors: perceived teacher support ($\beta = .31$, $p < .001$), access to after-school academic help ($\beta = .24$, $p = .002$), and culturally responsive pedagogy index ($\beta = .19$, $p = .014$). SES, while initially correlated, lost significance in the full model, suggesting school-level practices mediate SES effects.

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3. **Assessment Stress:** 68% of students reported "high" or "very high" anxiety during mathematics exams. Anxiety correlated negatively with achievement ($r = -.42$, $p < .001$).
4. **Language Barriers:** 57% indicated they sometimes did not understand word problems due to unfamiliar contexts or vocabulary. Those reporting frequent language barriers scored on average 4.7 points lower.

Qualitative Themes

1. **Deficit Narratives vs. Capability:** Students frequently described teachers categorizing them as "weak" or "slow." Yet, they narrated creative strategies for solving practical math problems at home (e.g., budgeting, measuring for construction), revealing hidden competencies.
2. **Pedagogical Support Matters:** Focus group excerpts highlighted teachers who used local examples (market prices, agricultural yields) and visual aids, which "made math make sense." These classrooms fostered confidence and curiosity.
3. **Assessment as Gatekeeper:** Students perceived tests as punitive rather than diagnostic. Requests for project-based or oral assessments surfaced repeatedly.
4. **Peer Networks:** Informal peer tutoring circles emerged as critical support structures, especially in hostels or community centers.

Triangulation

Quantitative data established statistical relationships between support variables and achievement, while qualitative narratives illuminated how those supports were enacted or withheld. For instance, while the regression underscored teacher support, focus groups detailed what counted as support: patient explanation, culturally relevant contexts, and celebrating small successes.

CONCLUSION

Equity in mathematics achievement for first-generation learners cannot be reduced to distributive justice alone. While resources matter, the crux lies in epistemic and procedural justice—whose knowledge counts, how learning is assessed, and whether pedagogies honor students' cultural and linguistic repertoires. This study demonstrates that when teachers adopt culturally responsive strategies, when schools institutionalize after-school support, and when assessments are diversified, first-generation learners close the achievement gap.

Policy implications include embedding equity criteria into mathematics curriculum standards, funding community-based math resource centers, and mandating professional development on culturally sustaining pedagogy. Schools should implement equity audits, tracking not only test scores but also participation, confidence, and classroom discourse patterns. Future research should employ longitudinal designs to track the durability of equity-focused interventions and explore intersectional identities (e.g., gender, caste, language) within the first-generation category.

Ultimately, achieving equity means reimagining mathematics classrooms as spaces where diverse ways of reasoning are recognized and nurtured—where first-generation learners are not merely accommodated but empowered as mathematical thinkers.

REFERENCES

- *Boaler, J. (2016). Mathematical mindsets: Unleashing students' potential through creative math, inspiring messages and innovative teaching. Jossey-Bass.*
- *Bourdieu, P. (1986). The forms of capital. In J. Richardson (Ed.), Handbook of theory and research for the sociology of education (pp. 241–258). Greenwood.*

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- *Civil, M. (2016). STEM learning research through a funds of knowledge lens. Cultural Studies of Science Education, 11(1), 41–59. https://doi.org/10.1007/s11422-014-9648-2*
- *Delpit, L. (2012). "Multiplication is for White people": Raising expectations for other people's children. The New Press.*
- *Gutiérrez, R. (2013). The sociopolitical turn in mathematics education. Journal for Research in Mathematics Education, 44(1), 37–68. https://doi.org/10.5951/jresematheduc.44.1.0037*
- *hooks, b. (1994). Teaching to transgress: Education as the practice of freedom. Routledge.*
- *Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. American Educational Research Journal, 32(3), 465–491. https://doi.org/10.3102/00028312032003465*
- *Martin, D. B. (2009). Researching race in mathematics education. Teachers College Record, 111(2), 295–338.*
- *Moll, L. C., Amanti, C., Neff, D., & González, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. Theory Into Practice, 31(2), 132–141. https://doi.org/10.1080/00405849209543534*
- *Nasir, N. S., & Shah, N. (2011). On defense: African American males making sense of racialized narratives in mathematics education. Journal of African American Males in Education, 2(1), 24–45.*
- *OECD. (2019). PISA 2018 results (Volume II): Where all students can succeed. OECD Publishing. https://doi.org/10.1787/b5fd1b8f-en*
- *Perna, L. W., & Titus, M. A. (2005). The relationship between parental involvement as social capital and college enrollment. The Journal of Higher Education, 76(5), 485–518. https://doi.org/10.1080/00221546.2005.11772296*
- *Reay, D. (2004). "It's all becoming a habitus": Beyond the habitual use of habitus in educational research. British Journal of Sociology of Education, 25(4), 431–444. https://doi.org/10.1080/0142569042000236934*
- *Rubie-Davies, C. M. (2010). Teacher expectations and perceptions of student attributes: Is there a relationship? British Journal of Educational Psychology, 80(1), 121–135. https://doi.org/10.1348/000709909X466334*
- *Ryan, A. M., & Patrick, H. (2001). The classroom social environment and changes in adolescents' motivation and engagement during middle school. American Educational Research Journal, 38(2), 437–460. https://doi.org/10.3102/00028312038002437*
- *Schunk, D. H., & Meece, J. L. (2006). Self-efficacy development in adolescence. In F. Pajares & T. Urdan (Eds.), Self-efficacy beliefs of adolescents (pp. 71–96). Information Age Publishing.*
- *Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. American Psychologist, 52(6), 613–629. https://doi.org/10.1037/0003-066X.52.6.613*
- *Stinson, D. W. (2013). Negotiating the "white male math myth": African American male students and success in school mathematics. Journal for Research in Mathematics Education, 44(1), 69–99. https://doi.org/10.5951/jresematheduc.44.1.0069*
- *Tate, W. F. (2008). "Geography of opportunity": Poverty, place, and educational outcomes. Educational Researcher, 37(7), 397–411. https://doi.org/10.3102/0013189X08326409*
- *Van den Broeck, A., & Van Houtte, M. (2016). Parental involvement and mathematics achievement: A cross-national assessment. Educational Studies, 42(2), 123–146. https://doi.org/10.1080/03055698.2016.1148581*