Contextualizing Mathematical Thinking with Urban Economics Education to Improve Mathematical Reasoning and Interest in Math in Black Students

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Abstract: Mathematical thinking is at the core of most STEM fields and there is little debate that there is a correlation between lower representation of certain demographics in STEM fields, generational wealth disparities in these groups and failing STEM programs in these communities are all tied. There is strong evidence that many students who go on to attend college from these communities overwhelmingly are represented in the humanities and social social sciences. There is support for the idea that in large part this is due to the desire to help the community and it can be argued the STEM at face has a marketing problem in presenting itself as a candidate for addressing the issues many of these students seek to address. Another variable is that poor quantitative scores play a role in preventing students from these communities entering in the field. This paper explores the topic of using Economics education as a merger of Mathematics and social sciences to contextualize mathematical reasoning so as to improve its marketability of Math as a problem solving tool in combating issues in these communities as well as improving mathematical thinking.

Problem: African American Mathematical Proficiency

There are huge differences among different ethnic and socio-economic groups in terms of academic achievement. Social Science literature often refers to these differences as disparities. Disparities however are not homogenous and neither are there reasons for existing. The types of disparities can fall into one of the three following categories:

1. Disparities in Educational Outcomes (Graduation Rates)
2. Disparities in Academic Achievement (Knowledge Proficiency)
3. Disparities in grade retention and disciplinary sanctions (repeating grades, suspensions etc)

And the causes of disparity are roughly of one of the three following categories:

1. differential or biased treatment of ethnic and racial minority students within the educational system
2. differences in socioeconomic status
3. different responses to educational systems or different sets of educational needs[1]

While gaps in disparities have been closing over the past several decades, they are still large in all three categories. Among Latinx and American Indian students for instance dropout status is 17% which is higher than both whites and blacks. Blacks with bachelor's degrees is 14% compared to 27% whites aged 25 and over.[2] In terms of college readiness 1 in 20 Black students are college ready compared to 1 and 3 white students and when narrowing the focus in on mathematical readiness 14% of Black students are math proficient.[3]

This paper seeks to explore the relationship between academic achievement and varied responses to educational systems and educational needs. It has been stated that much of the failure of HS Math curriculum for African Americans is the lack of cultural context which lends itself relevant to the lives of the students.[4] In one study it was demonstrated that afrocultural styles of teaching were strongly correlated with improved academic achievement, but afrocultural styles were lacking in the schools that needed it the most which were low-income african american schools. [5]

A more formalized discipline of Mathematics in a cultural context, known as ethnomathematics looks to explore the way in which ethnomathematics should be incorporated into the mathematics curriculum. Ethnomathematics is the application of mathematical ideas and practices to problems that confronted people in the past or are encountered in present contemporary culture.[6] Of the four major ways

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[1] https://www.apa.org/ed/resources/racial-disparities.pdf

[2] http://www.nea.org/home/15215.htm

[3] https://edtrust.org/wp-content/uploads/2013/10/TheStateofEducationforAfricanAmericanStudents_EdTrust_June2014.pdf

[4] https://scholarworks.lib.csusb.edu/cgi/viewcontent.cgi?article=1726&context=etd

[5] https://files.eric.ed.gov/fulltext/EJ1065901.pdf

[6] https://pdfs.semanticscholar.org/f857/1ded42f75b128fac6ddcf8300ee15ac79443.pdf

ethnomathematics should be implemented, the best suggestion was to continue to teach cultural mathematics with and incorporation of understanding ethnic differences.[7]

University of Hawaii has recently developed an ethnomathematics curriculum through their Graduate Program in Education meant to tackle the challenges of implementing ethnomathematics.[8]

In a statewide study of education in the Edo State of Nigeria, it was observed that 92% of teachers used ethnomathematics.[9] Edo State also boasts some of the best education in Nigeria, although there have been no formal studies to attribute that fact to their approach to mathematics compared to other areas of the country.

While ethnomathematics has presented itself as beneficial for improving math outcomes for disadvantaged communities it is not without challenges. The challenge is that ethnomathematics aspects are selected from student experiences or from their own environment and community, because as a paradigm , it is culturally rooted, and often there is no traditional syllabus or assessment standards.[10] Other problems which may be irreconcilable for the foreseeable future includes some of the following:

1. Teachers ill prepared to tackle class implementation of ethnomathematics in the united states
2. Culture backlash about denouncing western civilization and its benefits
3. Difficulty in transfer ethnomathematic education to standardized tests.
4. Many students have difficulties working in groups which is a necessary component of ethnomathematic learning.[11]

In short, while culturally relevant math education has benefit in improving mathematical reasoning and interest among disadvantaged populations, it faces an implementation and scaling problem.

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[7] https://link.springer.com/content/pdf/10.1023%2FA%3A1020532926983.pdf

[8] https://coe.hawaii.edu/academics/curriculum-studies-edcs/ethnomathematics#EthnoPLO

[9] https://files.eric.ed.gov/fulltext/EJ1132939.pdf

[10] https://pdfs.semanticscholar.org/f857/1ded42f75b128fac6ddcf8300ee15ac79443.pdf

[11] https://flm-journal.org/Articles/7E5EFFA4B24CB97110973C060200F3.pdf

Independent Variable: Urban Economics as a method of contextualizing mathematics education.