

LOOKING BEYOND THE GAP OF AFRICAN AMERICAN STUDENTS' PERFORMANCE: STATES TEST AND TEXT BOOK DRIVEN CURRICULUM UNSKILL MATHEMATICS TEACHERS

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ABSTRACT

African American students' mathematics poor performance has historical origins of oppression that has been strengthened by lack of implementation of suggested reforms. Interventions and reforms have suggested relevant pedagogy for minority students. However, classroom practices continue to alienate these students. This paper elicits the powerful factors that impede progress in implementing cultural relevant pedagogy for African American students and other students in general. Observations, informal interviews and cultural artifacts were employed data sources to elicit factors that inhibit mathematics learning these students were exposed to. The classroom practice of two fifth grade teachers indicate that State tests and textbook based instruction take precedence in teaching mathematics regardless of teacher awareness of the African American students' needs. Therefore this paper argues that State test and textbook based instruction deprofessionalise teachers in mathematics classroom and hinder learning opportunities.

Key words: *culture, mathematics education, African American students, classroom practices, textbook driven, State test-driven*

1. INTRODUCTION

The performance of African American students in mathematics continues to be the lowest in the U.S schools though the gap between them and other ethnic groups is narrowing (National Assessment of Educational Progress [NAEP] [1]. Disaggregation of the 4th grader result by ethnicity indicates that the mathematics score for Black students were 222 average, 227 for Hispanic students, 248 for white students and 255 for Asians [1]. Researchers have identified various reasons resulting to this lowest performance which includes the differences between the school instructional English and the home English language of African American students (Orr, [2]; Hollie, [3]. Some highlight the unfamiliar mathematics teaching context to these students' experiences (Tate [4]; Lubienski, [5]; lack of resources in schools that have the majority of African American students and lack of access to qualified teachers (Johnson and Kritsonis, [6]) due to their low socio economic status Hughes, [7]. Students themselves have criticized boring instruction that is teacher centered and not caring about their understanding (Strutchens and Westbrook, [8].

Research efforts continue to contribute on strategies that inform practice and policies on the nature of learning these students might succeed under Corey and Bower, [9]; Moody, [10]; Spencer, [11]; [8]). These studies suggest learner-centered instruction [9], stimulation of classroom discourse for social construction of understanding Moore, [12], use of manipulatives for mediation, and linking mathematical learning with entertainment Maloy, [13]. However, traditional mathematical classroom practices are still reported to be persistent Strutchens and Westbrook, [8].

This paper investigates what makes it possible/impossible to engage students in mathematical discourse and learner centered instruction. Presently there are limited studies, if any, that investigate factors beyond implementation/non-implementation of learner centered pedagogy that is inclusive to all students and strive for mathematical understanding. To elicit these factors, the paper employs two sub-questions, (1) what drives mathematical instruction that African American students receive in the two fifth grade classroom of Western New York public school? (2) What is the rationale behind the mathematical instruction on both classrooms? Socio-cultural theory and learning for African American students' literature influence this study's theoretical stance.

The paper is divided into five sections. The first section briefly presents the theoretical frame which is the lens used to discuss the investigated issues. To achieve this purpose, a focus will be on multiculturalism, mediation and learning potential. The second section describes the methodology used and thirdly the finding emerging from the collected data will be presented. In the fourth section the discussion and conclusion of the findings will be done, and lastly the implications of the study are presented.

2. THEORETICAL FRAMEWORK

The socio-cultural theory as championed by Vygotsky asserts that all children have potential for learning Vygotsky, [14]. Kozulin [15] highlights three important elements of socio-cultural perspective in learning and teaching as multiculturalism, mediation and learning potential.

2.1 Multiculturalism

Multiculturalism in education is described as integrating students' cultures in their learning. It acknowledges that there are multiple ways of knowing. [15] defines the notion of multiple ways of knowing by describing the role of psychological tools that are symbolic artifacts. These symbolic artifacts originate from all cultures with each culture having its own symbolic artifacts that children internalize and use to explore or learn new ideas. One example of these artifacts is literacy that children attain from home through observations, listening to adults and other children etc. When children internalize these symbolic artifacts, they become their psychological tools that assist their psychological function of perspective, memory and attention [15]. Activities that parents and the environment expose to children support the development of psychological tools children need prior formal learning.

Starkey and Klein [16] compared the socio-cultural influence of American children in their mathematical development with the Chinese and Japanese children. In their results Chinese and Japanese children enter preschool with superior mathematical performance compared to American children. In explaining this discrepancy [16] discovered that the early environment children experience influences their mathematical performance. The Chinese and Japanese culture exposes children to different experiences that develop their psychological tools to a mathematical superior level. Investigating these experiences [16] assert that Asian literacy develops number sense better than English. Asian mothers teach their children to count to high numbers before they enter formal schooling White, [17]. Thus, certify the role of different symbolic artifacts children experience in their development at home prior attending formal learning. Whereas in the United States the low economic status children tend to have limited mathematical experiences at home and therefore enter pre-school with a big gap from peers who are from the middle class homes. Unfortunately the majority of African American students fall under the low socio economic group of children. This gap has proven to be reduced through early learning childhood interventions Clements and Sarama, [18].

An ideal mathematics classroom culture for students African American have been studied intensively looking at teachers' attitudes and expectations Ogbu, [19]; Boykin,[20]; Ladson-Billing, [21] and [10]; students' success stories [12]; [13] and Stinson, [22]; influence of different teaching approaches Wilson-Jones and Clain, [23]; Berry III, McClain,[24]; Walker, [25]; and Jackson, [26]); and racial discourse inside mathematics classroom Nasir, et al [27]. Research also shows that mediation and acknowledgement of students' learning potential brings more success to students learning mathematics.

2.2 Mediation

Donato and McCormick, [28] and Karpov, [29] describe mediation as a tool of cognitive change that takes place in many forms such as textbook, manipulatives, classroom discourse, interaction with peers, and direct instruction from the teacher. Research shows that relevant successful mediation for African American students is against traditional practice [9]; [10]; [12]; [13]. These students' success in mathematics favors facilitation, [9]; [13]; student involvement, [12]; [13]; use of entertainment to link mathematical ideas [13]; co-operative learning, [23]; [12] and students' discourse [12].

Students view traditional practices as oppressive and impede their learning of mathematics [9]; [10]. Teaching of procedures [26] and limited language fluency of these students inhibit their success in learning mathematics [23]. Hughes, [30] p. 3115 recommends that (1) 'Black Children be taught by experienced, authentically caring, competent well prepared, mathematics teachers. (2) Are exposed to more complex and advanced mathematics. (3) Teaching and discipline practices are adapted to bridge home and school cultures. (4) Teachers find reasons to expect students to succeed at high level in mathematics. These recommendations encompass all the factors that increase mathematics performance of African American students, however the question is: Does practice reflect them?

2.3 Learning potential

In finding reason for high expectations educators should provide learning opportunities that aim at developing the child cognitively and socially Chaiklin, [31]. Educators need to aim their instructional activities at the child's current level of psychological function to achieve transition [31]. This level, the Zone of Proximal Development (ZPD) is hypothesized as the child's actual performance and learning potential [14]. [15], p.17 describes the role of ZPD as to inform educators about (1) 'psychological functions of the child emerging at a particular moment, not fully developed (2) the assisted performance that could be used as a legitimate parameter of assessment procedure (3)

how to conceptualize the difference between the level of the child's actual performance and learning potential. Aiming instruction at the student's ZPD depends significantly on teacher attitudes and values and beliefs Pourdavood et al., [32]. Those values include caring, commitment [21]; [19]; [20]; [12]; [22] believing that all students can learn mathematics and valuing students' respectful behavior and being responsible for their learning [13].

3. METHODOLOGY

A qualitative enquiry was employed to elicit the culture of the classroom that African American students were exposed to. This paper investigated intertwined variables and employed qualitative enquiry for its capability in addressing intertwined variables Glesne, [33].

Study Context and Participants

The school where research was undertaken was situated in a Suburban area of Western New York. The schools comprised of both middle and high school. There was a special mathematics classroom that had three computers adjacent to the door where student's worked on a mathematics program called "Study Island". On the other side of the classroom were two hexagon tables with four chairs around each, with students working individually. The walls of this classroom had mathematics learning aids and a chalkboard that was always occupied by students doing their mathematics. All other classrooms had desks arranged in rows with one or two teachers, one works as an assistant and one as a professional teacher.

There were fourteen African American fifth grade students in the whole school. Seven of them were in the math education class consisting of 5 boys and 2 girls while the other seven were on the special math education class, of 4 girls and 3 boys. The classroom observation targeted both classrooms and their math teachers.

3.1 Data Collection

This reported study used classroom observations, informal interviews with teachers and artifacts as data sources.

3.1.1 Observations

Passive classroom observations were used to observe the classroom culture through teacher-student relationship. A journal was used to record the observations during instruction and additional notes were made after each of the 22 classrooms visits. The classroom observations focused on visible teaching and learning approached, student teacher interactions, student to student interactions; which are some of the primary components of classroom climate. A series of 45 minutes mathematics lesson observations totaling 540 minutes were documented. To get an inclusive rich description of the observations classroom artifacts such as the classroom picture taken, learner aids and materials used for instruction were collected for analysis [33].

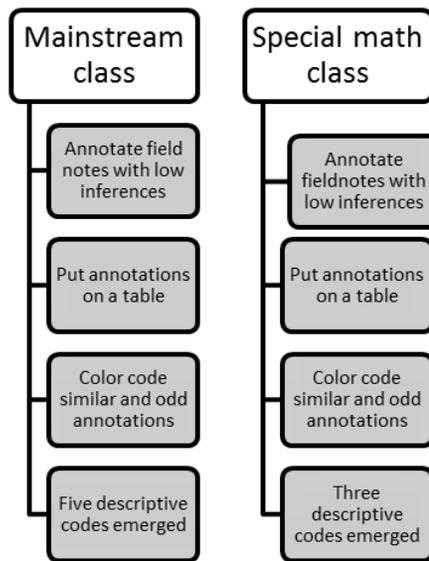
3.1.2 Interviews

Follow up semi structured interviews, from the classroom observations, with both teachers were conducted with the aim of gaining insight on the teaching practice and some meaning during instruction to validate observations and artifacts. These follow up interviews were used for triangulation with artifacts and field notes. The interviews gave teachers opportunity to describe their teaching in their own words. Depending on the amount of information needed, the interviews documented on a journal were approximately 5 to 10 minutes totaling 85 minutes.

3.2 Data coding and analysis

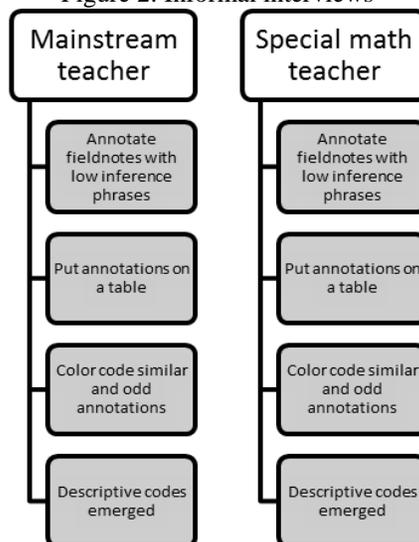
Data collection and analysis were inseparable because the analysis had to continuously inform data collection Ely, et al [34]. During classroom observation an on-going analysis kept the researcher within the study questions, as there were many opportunities to deviate from focus. After each observation, notes were added and annotated. Then the annotations (low inference phrases) were used to write analytical memos that assisted the next focus on observations. The data was used to respond to the research question from the classroom observations, artifacts, and informal interviews. All the field notes and interview transcripts were typed to make it easy to give each line numbers to assist my analysis. The first step was to annotate all the data separately from each data source. Figure 1 below give a visual detail of how the observation field notes were analyzed.

Figure 1: Observations

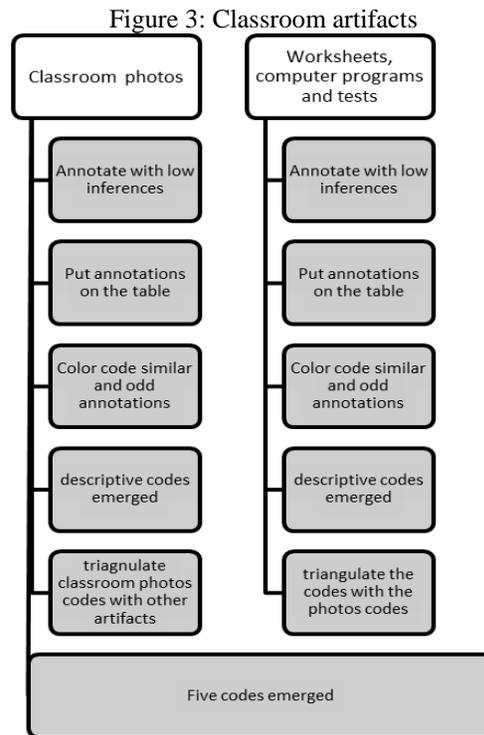


Approximately 12 classroom observations were documented. The analysis of the data from observations was on hold after the emerging descriptive codes to await descriptive codes of artifacts and interviews. The analytical memos for the classroom observations were used to strengthen the power of the descriptive codes that emerged. Figure 2 present analysis of informal interviews.

Figure 2: Informal interviews



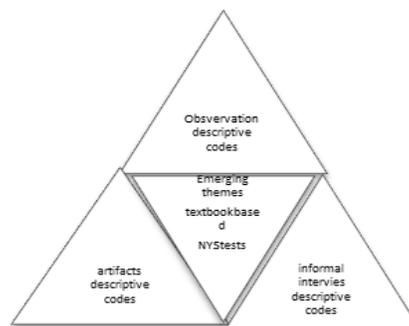
Analyzing the informal interviews field notes taken during the interviews were annotated in rows. These annotations were presented in tables and color-coded with the purpose of highlighting repetitions and unique occurrences. Colors made it easy to observe patterns, and established odd cases. An analytical memo was written about the picture that these annotations made. Three descriptive codes emerged from this analysis. Classroom artifacts analysis is presented on Figure 3.



Classroom artifacts were annotated on pieces of papers for the photos and on the copies of worksheets and tests. These annotations were later presented on a table and color coded for patterns and odd cases. An analytical memo was used to paint the picture displayed on the tables. Descriptive codes started emerging from the patterns and occurrences.

The descriptive codes from all three sources; observations, informal interviews and artifacts were triangulated. At first a table with three columns with descriptive codes was presented. However, it was hard to visually allocate any relations. Then a Venn diagram was used and then most of the codes started belonging and interacting with others. It was easy to see the emerging themes from the diagram. This diagram assisted in describing the emerging themes. Figure 4 present the triangulation and emerging themes.

Figure 4: Triangulation and emerging themes



4. FINDINGS

Presenting the findings, this paper begins by addressing the first question: what drives mathematical instruction in the two fifth grade classroom African American students in Western New York public school? Two themes emerged under the classroom culture observed.

4.1 Classroom culture

From the data analysis, the mainstream classroom was characterized by a textbook based instruction while the special mathematics education classroom was characterized by New York State tests. Following is the full description of each theme using the observed episodes.

4.1.1 Textbook based instruction

In the mainstream classroom the textbook guided the instruction. The textbook was used as a guide. Children read concepts from the textbook without any introduction during classroom and solved problems in the textbooks following the text description of the concept. The textbook page determined the sequence of concepts addressed. In this episode the teacher was reflecting on their responses from their homework. The following dialogue was between the teacher and Carmen (pseudonym).

Teacher: (reading from the textbook) Musa Manacov is a famous Soviet cosmonaut who spent a total of 541 days in space during two space flights. About how many weeks did Manacov spend in space?

(Students raised their hands) Yes, pointing to Carmen.

Carmen: 7 times

Teacher: What did you say again?

Carmen: (quiet)

Teacher: You said, divide. Give me the number.

Students: 7.....541

Teacher: Show me how you did this in your homework.

Carmen: (raise her hand)

Teacher: What Carmen?

Carmen: I do not understand?

Teacher: Why?

Carmen: I tried but could not do it. My mom did not know too.

Teacher: You were supposed to try Carmen. Otherwise if you don't try, you will never understand.

(Continued with her plan) Open your book on page 193.

Looking back at the approach of the teacher on the page 192 problem of Musa Manacov, the problem is complex; students need knowledge of multiple concepts. These concepts are time measurement, unit of a week compared to a day, knowledge of number facts and operations. Carmen in this case demonstrated knowledge of the unit of a week, in her response of "seven times" there is not enough information of what she meant as there was no probing from the teacher's side. In the - next problem on page 192 students were not given a chance to engage with the concepts but the teacher proceeded to problems in page 193 that focused on division with double-digit numbers. The following episode demonstrates the role of the textbook as the concept describe with no extended explanation.

Teacher: Let's go back to page 197. Compatible numbers are numbers that are easy to compute mentally.

(Reading from the book). Look at the examples. Estimate $23,078 \div 4$. Think 24 is close to 23 and is a multiple of 4.

(She writes) $23,072 \div 4$

$24000 \div 4 = 6,$

So $23,078 \div 4$ is about 6,000.

One African American boy, Joe, started getting confused and asked:

Joe: How does it divide to 24 now?

Teacher: It has to be a compatible number. Is 24 divisible by 4?

Joe: Yes

Teacher: Then in estimation, it has to be compatible.

Joe had no choice but to accept the explanation, even if it was unclear. Trying to understand this practice the researcher had the following conversation with the teacher:

Researcher: I noticed that all your work with your students is from the textbook. Sometimes you ask them to read explanations on the textbook. Is there a reason for that?

Teacher: Yes, there is a reason for that. The school expects us to use the textbook because it is part of the curriculum that we use in the school. Most parents expect us to teach their children from the textbook. That is why I ask them to work at home using their textbook because it is required.

From the classroom observation, it was very clear that the teacher was towing the line in following the text-book approach. Also evident was that some of the students were falling into the cracks and left behind whilst the teacher was rushing to finish his lesson plan.

4.1.2 New York State tests

The other mathematics class focused on students who were referred to by their teachers as struggling students in mathematics learning. Most of them were also attending special English class for students struggling with language. Lesson planning in this class was primarily influenced by the New York State test. When asked about her planning, the special mathematics classroom teacher responded:

Researcher: How do you plan your activities with them?

Teacher: I use the assessment report (checking the copy of it) we received about the performance gap in our school. Then I focus mostly on the reds, and then I give them pretest and post test to test their progress. I am not grading them.

From the above conversation, it appeared that the teacher uses the test as her starting point for student learning and teaching. Evidently, the teacher's role was to pull low performing students and bring them into an acceptable performance level before they join a normal class. However, this action did not consider student's future performances. For example, when students reach the expected performance and leave the special math class, they tended to struggle to cope in the mainstream class. During an interview the teacher was asked the following question:

Researcher: When students leave you because of their progress do they sometimes come back?

Teacher: Yes they do because as I said they become a number in the classroom and are left behind.

The revelation from the teachers clearly shows that the mainstream classroom instruction does not acknowledge these students as individuals with unique needs but rather treat them as others in this teacher's view. She also mentioned that these students are left behind in the mainstream classroom. The special math class's purpose is to pull the struggling students into the level that is required in the mainstream class. However, when they reach the acquired level, the mainstream class instruction makes them regress.

In this special math class testing students' computation skills and using the New York State (NYS) tests to drive the instruction characterized the daily instruction. A computer program was used to sharpen students' skills in different computations and concepts. Students worked individually on work on which they were behind. Most of the lessons followed the same procedure on daily basis, 3-minute time multiplication test followed by two groups, one doing test prep and the other practicing computation skill on the computer. When students wrote the New York State practice tests, they frequently asked the teacher for the meaning of the questions. For example the two questions students were struggling with were from a sample of NYS test, and the following dialogues took place:

Jeremy is selling raffle tickets to raise money for this class trip.

	Mon	Tues	Wed	Thurs	Fri
Tickets	3	7	9	4	<input type="text"/>
Money	\$18	\$42	\$54	\$24	\$72

How many tickets did Jeremy sell on Friday?

- A 10
- B 11
- C 12
- D 13

Student 1: I have circled 13 but I really do not know for sure.

Teacher: Do not worry at least you know it has to be a bigger number. I will be doing patterns with you soon

After few minutes another student went to the teacher:

Student 2: I do not know what to do with this one (pointing at the test) I do not understand.

The problem is as follows:

Robert took a survey of 100 fifth grade students to find out how tall they are.

Height	Students
5.5 feet	52
4.9 feet	26
4.7 feet	7
5.7 feet	15

How many more students are 5.5 feet tall than students that are 5.7 feet tall?

- A 27
- B 37
- C 43
- D 47

Teacher: How many students that are 5.5 feet tall? It should be on the chart.

Student: (Looking at the paper for a long time. Then, after the teacher said, "It should be on the chart" she responded.) 52.

Teacher: How many students that are 5.7 tall?

Student: 15

Both students presented in the above episode could not read the problem independently and solve it. The problem in this case was not mathematical understanding but literacy or lack of comprehension skills. One could not help but wonder if these students will be able to do these tests on their own. Their teacher talked about the situation:

Lots of the time they look at the problem and think it's too much information. Then I verbalize it for them and focus on the key words, and then they can work on it. Sometimes I have to sit with them and I ask them to look if the numbers are going up or down before they decide if they need to add or multiply or they need to subtract or divide. Teacher

This conversation shows that the teacher had a tendency to spoon feed the students. She was very sympathetic and hardly aiming to make the students independent thinkers. From the dialogue with the students, it is also clear that even the students have identified that their teachers would provide them with all the information they needed without even thinking themselves. Reading and interpreting for these students was not developing them independently. She also believed that African American students go through complex processes in learning. She eluded that:

"Their English is different to Standard English and therefore, before they solve problems, they need to read them first, translate them to their own language, then begin to think about how they are going to solve the problem and what skills they need to use. We treat them as others instead of acknowledging their difference."

This comment demonstrated the teacher's beliefs about the processes African American students go through while learning and caring nature that [30] advocates. However, New York State tests limit her horizons by being measuring stick of success for these students.

5. DISCUSSION AND CONCLUSION

The findings of this study reveal that textbook based instruction was prevalent or dominated one of the observed classrooms while the other classroom was dominated or characterized by NY state test. Textbook based instruction encourages continuation of traditional approaches that African American students perceive as being oppressive [12]. Active learning and classroom discourse are hypothesized to be successful approaches in the mathematics learning of African American students [21]; [12]. The textbook based instruction was characterized by one-way communication, learning procedures, and exclusion of students who have parents that cannot assist in solving mathematical problems. Ball and Feiman-Nemser, [35] support use of textbooks by beginning teachers because they still lack skills in developing their own curriculum and Jamieson, Grgurovic, and Becker [36] support use of textbooks for content knowledge. Research supports use of textbook in assisting new teachers and assisting in content knowledge. However, in this paper use of text book took away the most important elements of teaching; teacher professionalism, mathematical discourse that engages students ideas in it, use of students' experiences and environment in building mathematical concepts, diverse problems that include and expose learners to other cultures and practices.

Findings in this reported study indicates that diverse students' needs are not met in this kind of instruction. The challenge this study highlights is the embracing of diversity that needs to be integrated in teacher preparation not as a separate entity but as an integral part of teacher training. As [15] asserts, students from different cultures have difference psychological tools that they acquired from their cultures. For African American students, knowledge is constructed socially with the assistance of materials, educators and peers. The textbook alone cannot support their construction of mathematical knowledge. Also there is a need to acknowledge diversity in a broader sense than ethnicity, race, socio-economic background but including children from homes of parents with mathematics phobia

or lack of mathematical knowledge. Research shows that American students generally do not have the same amount of mathematical experiences at home compared to their Asian counterparts [16]. Expecting any American child to have parents with sound knowledge of mathematics is an unrealistic expectation. The role of the teacher should be more than reading a textbook but to connect these foreign ideas with students' experiences.

The State test has proven to exclude students' sophisticated levels of solution due to their nature [25]. Using them as a guide to teach is detrimental to the aim of education in developing children for lifelong learning. Teaching to the test limits students' creativity and development of mathematical higher order thinking levels. Both State tests and textbook based instruction have proven to be the power behind non-implementation of a socio-cultural pedagogy that has proven to increase mathematical performance of African American students. This paper informs policy on elements of education that continue to alienate African American students in effective mathematics learning

6. IMPLICATIONS

The two important components this study has highlighted as in need of attention are teacher preparation for mathematics education that is trusted by parents and the government. What is the use of training teachers to teach mathematics and expose them to all these theories if the schooling system does not trust their abilities; and cannot use testing for development rather than measuring performance of limited skills and knowledge? Teacher preparation has to take serious the mathematical content knowledge of students who enter the teaching profession Smidt et al, [37]. Textbook based teaching indicates lack of intrinsic trust, and extrinsic trust. By intrinsic trust I refer to teacher's own trust to his/her mathematical knowledge, by extrinsic I refer to the parents and curriculum designers who require some rigidity in how the curriculum is implemented, and school administration trust on their mathematics teachers' knowledge of mathematical pedagogy. In developing trust teacher preparation has to change towards attaining confidence in producing best mathematics teachers of all levels beginning from early learning childhood. The purpose of State tests need to be revisited and revised for development of mathematical understanding of students rather than measuring school performances. State tests in this study became a tool for hindering progress in learning of mathematical ideas. They continue to make African American students immigrants of mathematics learning. They make it difficult for them to own mathematical learning.

The reported study indicates barriers in achieving recommendations on teaching African American students mathematics [30]. In this case study teacher competency could not be observed in the mainstream class due to the use of textbook. Caring verbalized by the special math class teacher could not be demonstrated as the State test and textbook took over. Teachers were not decision makers in the matters of the curriculum. They could not choose the type of mathematical problems they would like to expose their students. They were guided by States test and textbook instruction. The learning seems not to bridge home and school and is likely to alienate those children with parents that lack the mathematical background knowledge. High expectations on these children are becoming impossible under these restrictions.

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