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Mastery Learning For 9th Grade Mathematics: Can the Self-Fulfilling Prophecy Close the Achievement Gap?

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Mastery Learning for 9th grade Mathematics:
Can the self-fulfilling prophecy close the achievement gap?

Rhonda Jeffries
and
Hope Reed

National Youth At Risk Annual Conference
2015
Standards-driven goals have discouraged the use of heterogeneous instruction; however, the achievement gap still exists despite homogeneous grouping.

According to the National Assessment for Education Progress (NAEP), White students outperform Black students in English and mathematics by 13% and 18% respectively (2011).

A culture of expectation has created floating standards for the various track levels with higher, more rigorous curricula and instruction for higher level tracked students and the contrary for lower level tracked students. (Agirdag, Avermaet & Van Houtte, 2013).

Recent findings based on more than 20 years of research suggest that despite decades of controversy, teachers do not perceive a problem with placing students into “ability [homogeneous] groups” (Toppo, 2013).
Review of the Literature

- There are measures that have been and are expected to close the academic achievement gap that exists between demographic groups:

- NCLB’s careful scrutiny of subgroup population was a result of growing concern and frustration over failed attempts to close the achievement gap (Overview, 2004; Williams, 2004).

- The CCSS focus on enabling teachers to take the time needed to teach core concepts and procedures well and to give all students the opportunity to master them is yet another attempt to address these deficiencies (CoreStandards, 2010).

- An ongoing debate exists about the impact of various grouping strategies on student achievement. Many schools have shifted to ability grouping, despite several critical research findings (Balanced View, 2002).
Rosenthal and Jacobsen (1968) originally described the self-fulfilling prophecy, or the Pygmalion Effect, simply as teacher expectations influencing student performance. Positive expectations influence performance positively, and negative expectations influence performance negatively.

Sorhagen’s (2013) longitudinal study noted that early teacher expectations disproportionally affect poor children's high school performance highlighting the significance of the Pygmalian Effect as early as first grade.

Champions of heterogeneous grouping point out that teacher expectations that contribute to tracking perpetuate a de facto means of segregating students along social and racial lines (Rubin & Noguera, 2004).

Hardre and Sullivan (2009) found that along with high school teachers’ perceptions of teacher efficacy, teacher belief and perception of student motivational needs influenced the selection and use of instructional strategies.
Research Question

Research Questions:

- How do Algebra 1 Part 1 (A1P1) recommended students (foundation level placement) perform when heterogeneously instructed in Algebra 1 CP classes?
- How does heterogeneous grouping of 9th grade Algebra 1 CP mathematics students impact:
  1) teacher expectations,
  2) student academic outcomes, and
  3) the associated achievement gap?
Significance of Study

The findings of this study may:

- Add to the understanding of how schools might increase student achievement by examining the influence of tracking structures on teacher perceptions of self-efficacy, teacher planning and instruction, and their expectations of these students.
- Assist administrators more carefully consider the impact of teacher instructional assignments and student classroom assignment.
- Address the influence of a curriculum designed to promote social justice.

The theoretical intention of this study is to bring awareness to the perceptions, attitudes, and expectations that teachers and students have toward their academic abilities. The study may assist with professional development of school personnel to develop and deliver curriculum which in turn either sets limits upon or unleashes possibilities for students.
Methodology

- This single case study employs qualitative research methodologies and descriptive statistics to explore how heterogeneous grouping of 9th grade Algebra 1 CP mathematics students impacts: 1) teacher expectations, 2) student academic outcomes, and 3) the associated achievement gap including:

  1) Interviews of Teacher Participants
  2) Review of Student Outcome Data
  3) Review of Archival Documents

- The purposefully selected sample includes eight Algebra 1 CP classrooms (382 students) from one large, suburban high school in South Carolina. Nine instruction staff including one department chair, one district math specialist and seven additional teachers.
**Participants & Setting**  
**Algebra I Instructional Staff**

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>Race</th>
<th>Teaching Experience</th>
<th>Age</th>
<th>Position</th>
<th>Hometown/Education/Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Female</td>
<td>White</td>
<td>1</td>
<td>25</td>
<td>Teacher</td>
<td>Moncks Corner, SC/UofSC/MAT</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>White</td>
<td>10</td>
<td>53</td>
<td>Teacher</td>
<td>Bozeman, MT/UofSC/MA</td>
</tr>
<tr>
<td>3</td>
<td>Female</td>
<td>Black</td>
<td>2</td>
<td>26</td>
<td>Teacher</td>
<td>Milwaukee, WI/UofSC/MAT</td>
</tr>
<tr>
<td>4</td>
<td>Female</td>
<td>White</td>
<td>36</td>
<td>58</td>
<td>Teacher</td>
<td>Clinton, SC/Clemson; Columbia College/MA</td>
</tr>
<tr>
<td>5</td>
<td>Male</td>
<td>White</td>
<td>9</td>
<td>36</td>
<td>Teacher</td>
<td>Ninety Six, SC/Presbyterian; Phoenix/MEd</td>
</tr>
<tr>
<td>6</td>
<td>Male</td>
<td>White</td>
<td>3</td>
<td>24</td>
<td>Teacher</td>
<td>Columbia, SC/Duke/MAT</td>
</tr>
<tr>
<td>7</td>
<td>Female</td>
<td>White</td>
<td>28</td>
<td>53</td>
<td>Teacher</td>
<td>Summerville, SC/UofSC/MAT</td>
</tr>
<tr>
<td>8</td>
<td>Female</td>
<td>Black</td>
<td>22</td>
<td>47</td>
<td>Department Chair</td>
<td>Sumter, SC/Oakwood; UofSC/EdD</td>
</tr>
<tr>
<td>9</td>
<td>Male</td>
<td>Black</td>
<td>12</td>
<td>32</td>
<td>District Specialist</td>
<td>Columbia, SC/SC State/MA</td>
</tr>
</tbody>
</table>

The high school under investigation is part of a district that serves over 25,000 students in suburban and rural areas and enrolls approximately 1600 students with a racial composition of 48% Black, 46% White, 3% Latino, 1% Asian, and 2% other. There are 28% of the students who are eligible for free or reduced lunch. There are 94 teachers at the school and 35 of those are National Board Certified.
Participants & Setting

- There is a disproportionate number (49%) of free/reduced lunch students recommended for foundation level math (Algebra 1 Part 1) in contrast to the total percentage of free/reduced lunch students (28%) at the participant school.

**Socio-Economic Status Distribution**

- **A1P1 Students**
  - 51% Free
  - 38% Reduced
  - 11% Full Price

- **School**
  - 72% Free
  - 20% Reduced
  - 8% Full Price
Participants & Setting

- There is a disproportionate number (69%) of Black students recommended for foundation level math (Algebra 1 Part 1) in contrast to the total percentage of Black students (48%) at the participant school.

Ethnicity Distribution

**A1P1 Students**
- Black: 8%
- White: 23%
- Latino/Asian/Other: 69%

**School**
- Black: 46%
- White: 48%
- Latino/Asian/Other: 6%
Data Collection and Analysis

- Case study research design utilizes multiple points of evidence in order to build reliability and validity (Yin, 2009). Interview and document analysis were the primary data sources.
- Multiple interviews with the department chair were conducted to gauge the tone, response to and effectiveness of the heterogeneous de-tracking initiative.
- Algebra 1 Part 1 student placements were analyzed to determine effectiveness.
- Multiple documents were analyzed to triangulate the interview data regarding tone and effectiveness of the initiative.
- Members checks and peer debriefing were conducted.

*Self-Fulfilling Prophecy achieved through:*

1) Leadership,
2) Teacher Buy-In, and
3) Student Outcomes
Findings

- **Self-Fulfilling Prophecy achieved through: Leadership**

- **Results:** This de-tracking effort was initiated through the leadership of the department chair. A pilot study with Algebra 1 Part 1 (A1P1) students who lived up to the department chair’s expectations was the impetus for the current study.

- Students recommended for Algebra 1 Part 1 course were told they were in a College Prep (CP) section and were subsequently assigned CP level work.

<table>
<thead>
<tr>
<th>Pilot Study</th>
<th>A1P1 (A1CP instruction)</th>
<th>Ethnicity</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>49</td>
<td>B=42</td>
<td>M=24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W=6</td>
<td>F=25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L/A/O=1</td>
<td></td>
</tr>
<tr>
<td>Passed</td>
<td>44</td>
<td>B=37</td>
<td>M=22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W=6</td>
<td>F=22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L/A/O=1</td>
<td></td>
</tr>
<tr>
<td>% Rate</td>
<td>90%</td>
<td>B=88%</td>
<td>M=92%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W=100%</td>
<td>F=88%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L/A/O=100%</td>
<td></td>
</tr>
</tbody>
</table>

- This pilot study suggested that the majority of A1P1 students by recommendation of 8th grade teachers were capable of performing at a higher level when offered an opportune use instructional strategies.
Findings

- **Self-Fulfilling Prophecy achieved through: Teacher Buy-In**

- **Results:** Department teachers embraced the heterogeneous instruction initiative and participated in the design of the Mastery Learning approach that the department selected to use. Mastery Learning is based on the philosophy that all children can become achievers when taught at a level of their own proficiency and encouraged to progress at a rate of their ability to master clearly defined units of learning.

  - Teachers’ responses to the program:

    “I thought it was a good idea in theory, but I wasn't sure it would work in practice. It has exceeded my initial expectations, so far.”

    “I have mixed emotions because I do believe that many of the kids have stepped up and are doing fine in A1CP instead of A1P1. I don't think that would be the case if it weren't for the extra time to work and get more help during seminar [preview sessions] so I think the seminar is working well for most of the kids in it.”

    “I am very excited! Tracking is something that always concerned me even when I was in high school. Some students will never have the opportunity to take a calculus course solely based on the track that they were given. The new system gives everyone an equal opportunity to succeed mathematically and I love that.”
Findings

Self-Fulfilling Prophecy achieved through: Student Outcomes

Results: Algebra 1 Part 1 (A1P1) recommended students performed well in Algebra 1 CP. 159 recommended students were placed in A1CP and 119 (75%) of those were passing at the end of the semester. The remaining 40 (25%) were recommended for placement in A1P1 in order to prevent failure and gain credit.

A1P1 earns 1 high school credit (.5 math credit), however students on this track typically do not complete Algebra 2 in high school – the base line mathematics readiness course for college attendance. This initiative increased the number of students on pace with college preparation math by 53%.

<table>
<thead>
<tr>
<th></th>
<th>A1P1 (Recommended)</th>
<th>A1CP (Total)</th>
<th>A1CP Increased Success Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>159</td>
<td>382</td>
<td>223 (A1CP recommended)</td>
</tr>
<tr>
<td>Passed</td>
<td>119</td>
<td>342</td>
<td>119 (A1P1 passed)</td>
</tr>
<tr>
<td>% Rate</td>
<td>75%</td>
<td>90%</td>
<td>53%</td>
</tr>
</tbody>
</table>
Summary of Findings

- Preliminary findings suggest that college preparatory mathematics can be successfully accessed by a greater numbers of students when offered with appropriate instructional supports.

- Based on the associated race/ethnicity and gender demographics of the A1P1 students, de-tracking positively impacts the achievement gap that plagues African American, and in particular male, students.

- Dedicated leadership and teacher buy-in are critical factors to implement an effectively de-tracking program that produces student academic achievement.
Implications for Practice

- Faulkner, Stiff, Marshall, Nietfeld and Crossland (2014) noted the significance of race and teacher evaluations as predictors of algebra placement where Black students are disproportionately recommended for lower level classes despite academic performance.

- Professional development opportunities might provide expanded latitude for in-service teachers to experiment with adjusted grouping strategies and curriculum options.

- Administrators at the building and district levels might consider unifying and raising expectations for a wider range of student learners and reducing the number of students identified and scheduled for lower level classes.

- Educators at all levels might consider the social justice implications for acknowledging the conflicting evidence that tracking presents. The counter hegemonic data presented in this study support practices such as de-tracking that challenge social stratification in educational settings.
Future Research

- This longitudinal study presents first semester data which includes course outcomes based on test scores, curriculum planning and effective leadership. Data will continue to be collected at semester intervals to compare student performances, gauge teacher expectations and instructional practices and investigate leadership strategies.

- Current analysis includes reviewing trends across the A1P1 recommended students who did not pass to better identify those potential failures and recommend more effective placements. These identification criteria will be more carefully structured and scrutinized to reduce the number of faulty recommendations as well as to eliminate mid-year scheduling dilemmas.

- Including administrator data might offer explanations for teacher/staff perceptions toward de-tracking and their ability and/or willingness to challenge this traditional system.
Conclusions

- A1P1 recommendations are saturated with more Black and low SES students. More attention must be given to assisting these students with their academic achievement and this attention begins with a simple opportunity and ends with specific, effective instructional supports.

- Opportunities to expand success for a greater number of students, in particular those from categorically marginalized populations, must reside in the practice of utilizing well-designed mathematics curricula and instructional strategies. This is especially critical to the reduction of social inequities based on the lost opportunities presented by a lack of student readiness for math in K-12 classes, preparedness for post-secondary instruction, and mathematics dependent employment (Sullivan, 2015).