**Tracking and Student Achievement: The Role of Instruction as a Mediator**

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**Introduction**

The relationship between tracking and student achievement has been widely studied, establishing that there is a significant gap in achievement gains between students in high- and low-track mathematics classrooms. Researchers on both sides of the tracking debate have argued that instructional quality may be the mechanism by which tracking helps or harms students. Yet, the vast majority of studies in this area are small case studies and/or have relied on teacher self-report of instructional behaviors. To answer the question of whether instructional quality has an impact on the relationship between tracking and math achievement, we must start with a mathematics-specific definition of high quality instruction and carry that through a full quantitative mediation analysis.

**Research Questions**

(see graphic below)

1) Are there measurable differences in instructional quality between teachers in high- and low-track classrooms?
2) Do differences in instructional quality mediate the relationship between track level and achievement?

**Data**

This analysis uses data from the Middle School Mathematics in the Institutional Setting of Teaching (MIST) study. MIST is an ongoing NSF-funded project examining the relationship between institutional supports, instructional practices and student learning in 30 middle schools in four large, urban districts. Within these schools, teachers were randomly selected and recruited to participate in the study. Between 17 and 38 teachers participated in each district in each year. These teachers were videotaped during instruction for two consecutive days, and their students’ achievement data was collected.

**Measures**

1) Tracking variables: class-level data shared by the districts, supplemented by teacher and principal reports from one-on-one interviews where necessary
2) Instructional Quality Assessment (IQA) is a math-specific measure applied to two observations of classroom instruction. This analysis uses scores on Task Potential, Task Implementation and Discussion, rating each as high or low rigor. High rigor involves tasks with multiple solution paths, and allows students to make connections between ideas and communicate their thinking
3) Student achievement is the student’s score on the state assessment, z-scored to the state distribution and controlling for the prior year’s score

**Research Question 1**

Are there measurable differences in instructional quality between teachers in high- and low-track classrooms?

To answer this research question, I used multi-level logistic regression to predict the probability to score a three or higher (high rigor) on each IQA rubric from the track level (high or low) of the course. Unconditional models revealed the need for two levels: classes nested within teachers. A school level was also tested, but accounted for less than 1% of the variation in IQA scores. Models included classroom-level controls and district and year fixed effects:

Level 1 (Student): IQA = β0 + β1*High Task Potential + β2*High Task Implementation + ε

Level 2 (Teacher): IQA = γ + ρ * Track Level + ε

**Research Question 2**

Do differences in instructional quality mediate the relationship between track level and achievement?

To answer this research question I require a model predicting student achievement from IQA scores, controlling for track level:

Level 1 (Student): Achievement = α + β1*IQAH + β2*IQAI + β3*IQAD + ε

Level 2 (Class): Achievement = γ + ρ * Track Level + ε

Level 3 (Teacher): Achievement = γ + ρ * Track Level + ε

Level 4 (District): Achievement = γ + ρ * Track Level + ε

Then, I employed the product-of-coefficients method (Zhang, Zypher and Preacher, 2008), multiplying the coefficient on the track level variable in Equation 1 by the second-level coefficient on the IQA variable in Equation 2: β1 * β2

**Methods**

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**Research Question 1**

Are there measurable differences in instructional quality between teachers in high- and low-track classrooms?

There is not a consistent relationship between track level and achievement can be accounted for by the greater likelihood of rigorous task potential in high track classes (p<0.10). Although there are large differences between track levels in the rigor of the tasks used and discussions held, these differences do not account for much of the gap in student achievement because the achievement tests are not highly correlated with these aspects of instructional quality.

**Research Question 2**

Do differences in instructional quality mediate the relationship between track level and achievement?

The only mediation effect that was marginally statistically significant was the path of track level through task potential. Although there are large differences between track levels in the rigor of the tasks used and discussions held, these differences do not account for much of the gap in student achievement because the achievement tests are not highly correlated with these aspects of instructional quality.

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**Conclusions**

Despite the strong relationship between instructional quality and track level, only Potential of the Task was found to be marginally significant as a mediator. The minimal mediation found here is likely due to the small size of the relationship between the measure of instructional quality and student achievement.

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**Adjusted Achievement Gap between High and Low Track Classrooms**

<table>
<thead>
<tr>
<th>Task Potential</th>
<th>Implementation</th>
<th>Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.006**</td>
<td>0.051**</td>
<td>0.119***</td>
</tr>
</tbody>
</table>

As the figure below shows, students in high track classes had more than 20 times the odds of encountering rigorous tasks implemented in their classrooms, and about twice the odds of having rigorous discussions, when compared to students in regular/low track classes.