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Racial/Ethnic Gaps in U.S. Children's Math Skills in Elementary School



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Introduction

- Black and Latino U.S. children generally obtain significantly lower math and reading scores than White children (Lee & Bowen, 2006; National Research Council, 2009), even after controlling parents' education and income (Fryer & Levitt, 2004; Reardon & Galindo, 2009).
- We need to understand better factors associated with school success, particularly for underserved populations.
- Claussen & Engel (2011) investigated whether children's math skills at the start of kindergarten serve as a protective factor and predict subsequent math performance. Proficiency in number sense in kindergarten was the best predictor of eighth grade math scores. However, they did not consider racial/ethnic gaps.
- Sonnenschein and Galindo (2015) found that the Latino-White gap was no longer statistically significant at the end of kindergarten once math proficiency (age appropriate number sense) at entry was considered, but the Black-White gap was. Home and classroom factors further narrowed but did not close the gap.
- Not surprisingly, growing up in a stimulating home environment is associated with children's academic outcomes (Crosnoe & Cooper, 2010; LeFevre et al., 2009).
- Research on classroom factors, particularly the amount and quality of instruction, is generally positively associated with children's academic development (Byrnes & Wasik, 2009; Pianta et al., 2008).
- To fully understand the sources of children's underperformance, however, it is necessary to expand the research base to include school factors.
- Carter & Welner (2013) discuss the "opportunity gaps" experienced by low-SES and children of color in the quality of schools they attend. Such schools generally have more limited resources, less qualified teachers, and are located in higher crime neighborhoods.
- Research has not sufficiently investigated:
 - Group-based growth trajectories of children's math skills based on their skills at kindergarten entry;
 - How school factors impact different groups;
 - Whether school factors interact with the math skills children display at school entry.

This Study:

- Investigates the gap in math achievement from kindergarten through spring of 5th grade for Black, Latino and White children who start school with age-appropriate math skills (proficient) versus those who do not (not proficient).
- Compares school-level risk factors for these different groups: eligibility for free lunch, attendance, percentage of minority children, threats to school safety, and percentage of children proficient in math within schools.
- Documents the impact of school proficiency on group-based gaps in math achievement from kindergarten through fifth grade, after controlling for child and classroom factors.

Method

Sample

- First-time White, Black, or Latino kindergarteners ($N = 8,476$, 50% males) from the 1998 Early Childhood Longitudinal Study Kindergarten Cohort (ECLS-K).

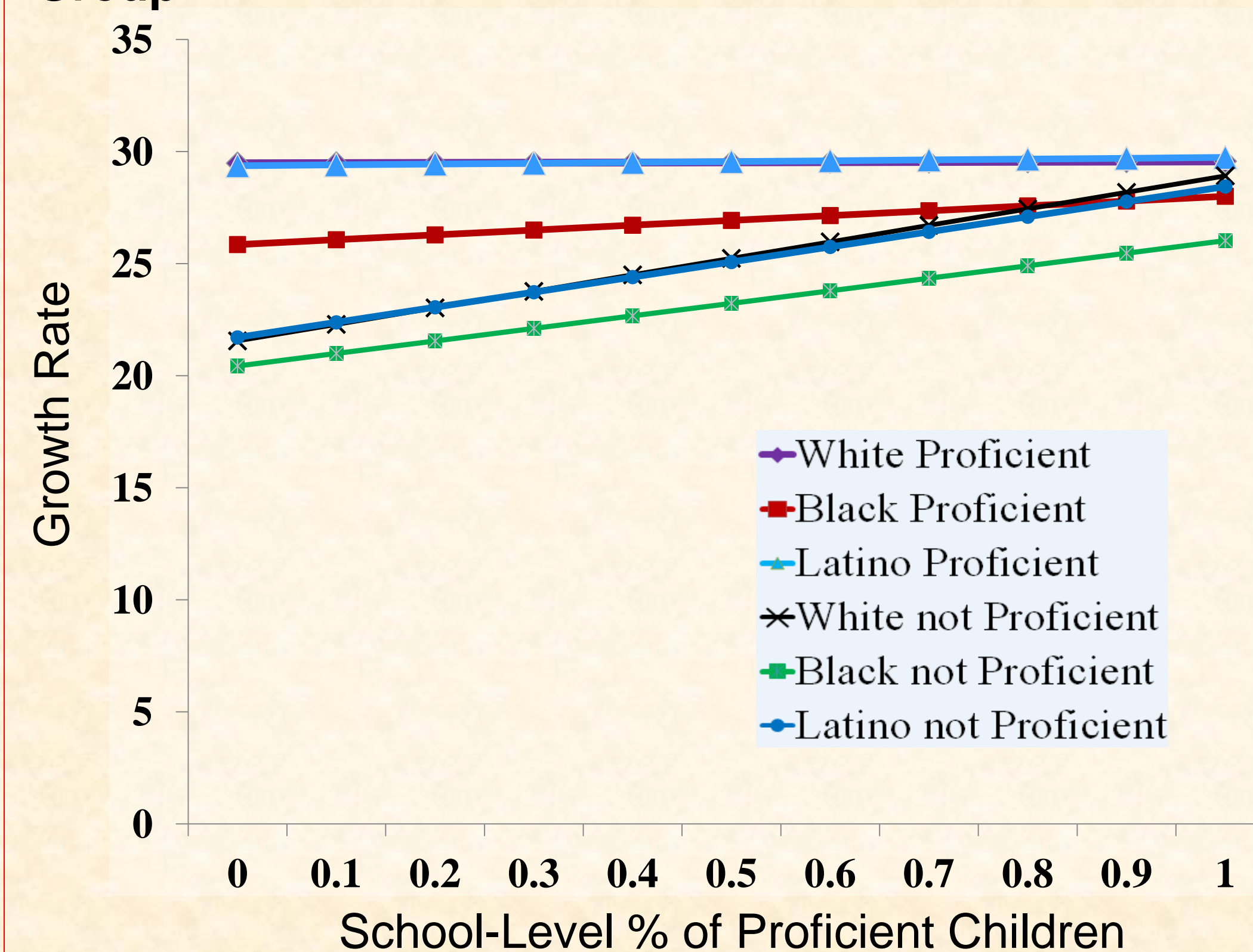
- Based on ethnicity and fall kindergarten math proficiency, the sample was divided into six groups: 43% White proficient, 31% White not proficient, 4% Black proficient, 10% Black not proficient, 3% Latino proficient, and 8% Latino not proficient.
- Proficiency in math at entry to kindergarten was defined as attainment of Level 2, relative size.

Measures

- Math skills measured by standardized IRT scores in spring of kindergarten, first, third and fifth grade.
- Child-Level Covariates:**
 - Gender, family structure, number of siblings, parental education, socioeconomic status, language spoken at home, approaches to learning, primary child care before K, full vs. half day K, family expectation for school outcomes, parental involvement in school, home activities, and fall kindergarten math skills.
- Classroom-Level Covariates:**
 - Amount of teacher-reported math instruction: never, less than once a week, 1-2 times a week, 3-4 times a week, and daily.
 - Teacher's highest education level: high school/associate degree/bachelor's degree, at least one year beyond bachelor's degree, master's degree, education specialist/professional diploma, and doctorate.
- School-Level Covariates:**
 - Public vs. private school
- School-Level Variables of Interest:**
 - % of students eligible for free lunch
 - Attendance
 - % of minority students
 - Threats to school safety: tension from differences, problem from unkempt areas, substance abuse, gangs, heavy traffic, violent crime, vacant buildings, crime in area, children with weapons in school, direct theft from children, physical attacks or fights.
 - School-level math proficiency: calculated as % of children who were proficient within each school.

- Attendance:**
 - On average, all children attended schools with high rates of attendance.
 - However, of proficient students, Black proficient children were most likely to attend schools with a lower percentage of children in attendance.
 - Of not proficient students, Black children attended schools with lowest percentage of children in attendance.
- Minority:**
 - Of proficient children, Black children attended schools with the highest percentage of minority children.
 - Of not proficient children, Black children attended schools with the highest percentage of minority children.
- Threats to school safety:**
 - Of proficient children, Black children attended schools with highest threats to school safety.
 - Of not proficient children, Black children attended schools with highest threats to school safety.
- Math proficiency:**
 - Of proficient children, Black children attended schools with lowest rates of school-level proficiency.
 - Of not proficient children, Black children attended schools with lowest rates of school-level proficiency.

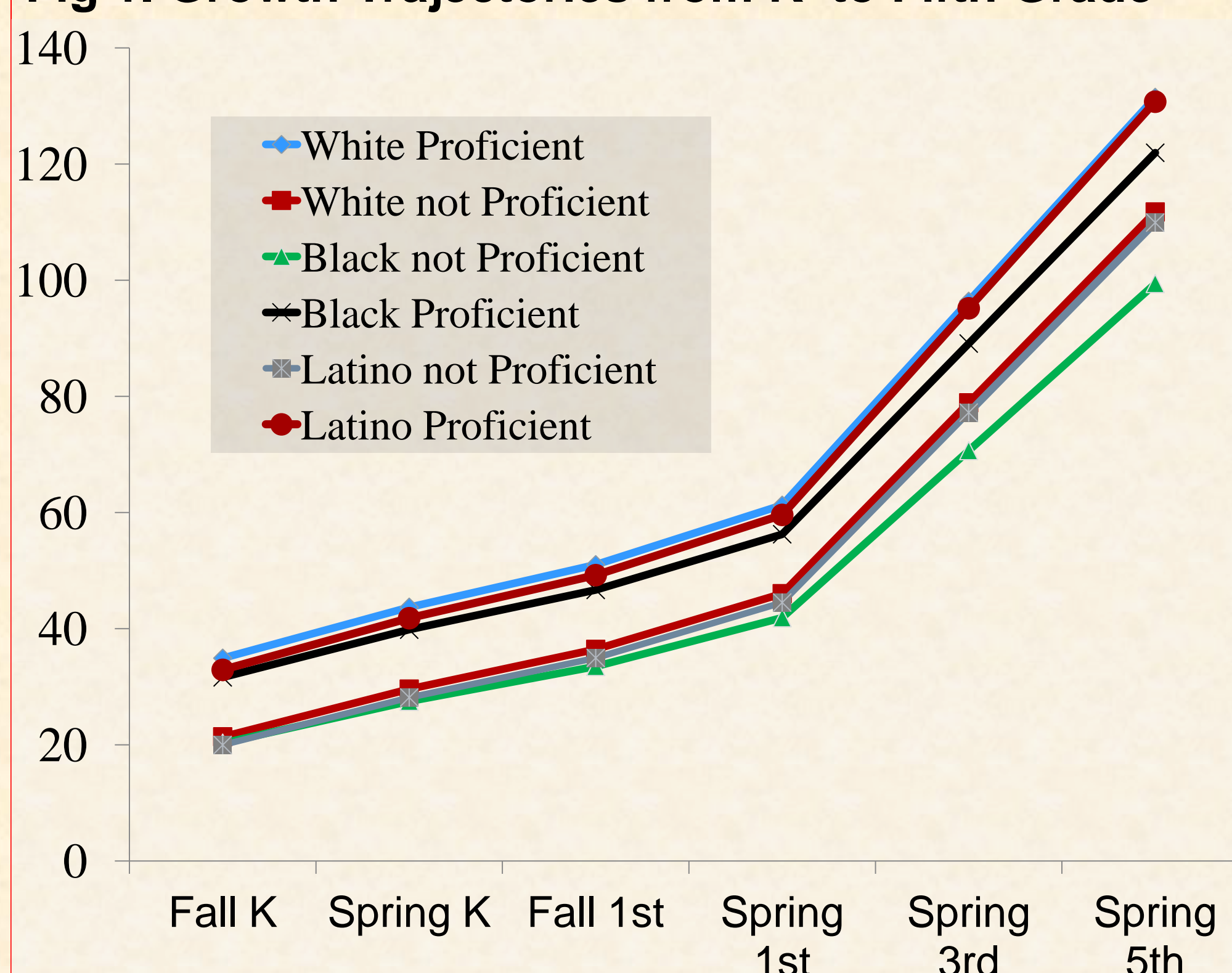
Fig. 2. Growth Rate Varied by School Math Proficiency * Group



- There was a significant three-way interaction between grade, school-level math proficiency, and group, after controlling for relevant child-level and classroom-level covariates.
- Threats to school safety had negative effects on growth rates. This effect did not vary across groups.

Results

Fig 1. Growth Trajectories from K to Fifth Grade



Multilevel modeling was used to take into account the nested nature of the ECLS-K study.

School-Level Descriptives

- Eligibility for free lunch**
 - Of proficient students, Black proficient children attended schools with a higher percentage of children eligible for free lunch.
 - Of not proficient students, Black children attended schools with the highest percentage of children eligible for free lunch.

Discussion

- There were significant group-based gaps in math achievement as children proceeded from kindergarten through fifth grade.
- Far fewer children of color started kindergarten with age-appropriate math skills. Children who did not start kindergarten with age-appropriate math skills did not catch up with their peers who did start with such math skills. Thus, group-based gaps increased over time.
- Consistent with Carter and Welner (2013), children of color, particularly Black children, generally attended schools with a higher percentage of minority and free lunch eligible students, lower attendance rates, fewer students proficient in math, and more threats to school safety than White children.
- Even though some Black children began kindergarten with age-appropriate math skills, their relative math achievement decreased over time.
- In contrast, starting school with age-appropriate math skills was a protective factor for Latino and White children.
- Future research should focus on why school math proficiency is relevant for some students but not others. Of critical importance is to determine what can we do to close the achievement gaps for Black children.