

Attaining the Elusive: Efficacy, Math Education and Black and Latino Students

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Abstract

Low enrollment of Latino, African American, Native American, and Southeast Asian American students in science, technology, engineering, and math (STEM) classes, via advanced placement (AP) courses, remains a problem for high schools, and education leaders across the United States. More than just examining the factors behind this enrollment issue, we wanted to understand the focal factors underpinning success in AP courses of those few who do enroll. For that purpose, we grounded this case study on social cognitive theory's central variable of self-efficacy. We found that teacher facilitated experience plays a pivotal function in students' success in STEM education, more specifically, AP math.

Keywords: mathematics, efficacy, diversity

INTRODUCTION

Low enrollment of Latino, African American, Native American, and Southeast Asian American students in science, technology, engineering, and Math (STEM) advanced placement (AP) classes, remains a challenge for high schools across the United States (Brown & Campbell, 2008; Klopfenstein, 2004; Lichten, 2007; Ndura, Robinson, 2003; Trounson & Colvin, 2002). The impact of this issue can more immediately be felt on the day-to-day experience of youth in schools. In the long term, we fear this issue could have far reaching effects that impact economic security and, perhaps, the nature of the country's democratic system.

More than the factors behind the school system's enrollment failure, we wanted to understand the focal factors underpinning success in AP math courses of those few who do enroll. For that purpose, we grounded this study on social cognitive theory's central variable of self-efficacy. We followed Bandura's (1991) four factors defining self-

2009). When youth attend schools in which Black and Latino make up the numerical majority, they tend to be under-enrolled in said courses (Handwerk, 2008; Solorzano & Ornelas, 2004). Yet, one of the main drivers of STEM education is the perceived lack of sufficient scientists and engineers entering the country's workforce which in turn, as Salzman & Lowell (2007) have argued, threatens the United States' economic health and relevant position in global innovation. This workforce shortage appears worse among Black, Latino, Native American, and South-East Asian populations.

Whiting and Ford (2009), among others, have suggested a link between this under representation and a low offering of AP courses in schools, particularly serving low-income families, where these populations form the majority. Moreover, as Arellano & Padilla (1996), and Gándara (2006) have shown, the lack of familiarity with crucial information - such as the prerequisites of AP courses, when to take SAT exams, how to apply for financial aid - plays a key role in explaining the low numbers of Blacks and Latinos in the AP track. Environments such as the ones so far described, may only engender a perpetual cycle of low tracking in math and science. But the fact that in these same environments students from these two communities still enroll and some even succeed, confirmed to us the need to look closely at self-

programs (e.g. Head Start). Martinez Alemán (2006), following national statistics, suggested that in the United States fewer than half (45.3%) of Latino four-year-olds were enrolled in pre-primary education, as compared with almost sixty percent of White four-year-olds. Latino children, according to these national figures, were more likely to repeat grades than Whites. Although Latino nine-to-eleven-year-olds were as likely to be retained in grades as Whites, among older children (12-to-14-year-

Interview data were transcribed, coded, and analyzed according to the guidelines set forth by Hibbs (2012), and Usher (2009) and using the Hyper-RESEARCH program. A total of (N) 35 twelfth graders enrolled across three AP calculus courses and in two different high schools were first surveyed. From this convenience sample we selected twelve for a series of interviews; they were organized in five small focus groups with the intent to cross-reference and triangulate the results of the survey. The survey questions for this study employed the intermediate degrees of assurance. The study also applied the Statistical Package for the Social Sciences (SPSS) to conduct a frequency analysis for each of the survey questions. In order to understand which variable contributed the most to the Latino and African American students' entry into AP calculus, we conducted a frequency analysis of each response by ethnicity.

Setting

This sequential mixed methods study took place in Urban Unified School District (UUSD), a large, comprehensive school district in northern California. It enrolled 37,040 students in the 2013-2014 school year. Of the seven high schools, two were selected for the study based on two criteria. The first one being the general geographical distinction: one school is set in "the hills", which serves a neighborhood that tends to be more affluent than the rest of the city, and the other located in "the flatlands"

FINDINGS

The salient role of experience — as a factor forging efficacy — throughout the study's data, lead us to report here the study results for this variable and its different components. We decided that the other three variables - modeling, social persuasion, and physiological factors - needed separate attention. These emerged as insignificant forces shaping students' determination to enroll in AP course work. Indeed, about four (45%) out of nine of Latino

Figure 3. Survey results based on middle school preparation.

Mario's experience resonates with that of Rosalba's. Without naming a specific teacher, he sums up his general positive experience from his early schooling this way:

I went to elementary school in an urban school, which was not the highest quality, but I was considered a good student, a smart student. (Interview series, March, 2015)

Mario speaks of the surrounding environment. He knew that adults had framed his participation as good, and personally, as someone intelligent. In such a context Mario seemed to be cognizant that his only option consisted of one thing: high academic performance as a way to meet teachers' expectations.

Benard, an African American youngster, explains teacher's agency in similar terms to the other participants. He says:

My best teacher was in 7th grade, his name was Mr. P. The way he would teach was calm and he wouldn't teach directly out of the book, he had his own techniques. The students in that class would actually understand more than just reading of the paper and trying to figure out. (Interview series, February, 2015).

Sheena, also African American, refers to the role played by the adults. She extends the positive, gentle cajoling of a teacher to include that of a tutor:

One is Ms. M. and another is a tutor that teaches at Urban Technical High School, his name is Mr. H. They pushed me. I started going there at the beginning of the year. They pushed

CONCLUSION

We found that experience is the most prominent force influencing African American and Latino students to enroll in AP courses in high school. Of all agents present in their academic experience it is teachers first, and parents secondly, the ones who tend to exert the greatest influence on the decision to take math and science courses. While such influence varies from grade level to grade level, the teachers' central role stayed constant.

Findings revealed that perceived confidence was the greatest reoccurring factor for participants, and that again teachers played a central role in facilitating it. Experience that contributes to the development of confidence is what students in general must be exposed to. In the case of African American and Latino students, this assertion not only becomes magnified but also urgent. To increase the quality and numbers of these two population's entrances into the high track of math and science, and the engineering professions in college, educators ought to pay closer attention and be willing to disrupt these students low-tracking experiences early on.

As with Pajares' (2002) research, our study found that students who perform well on math tests and earn high grades in math classes are likely to develop a strong sense of confidence in their math capabilities. We discovered that confidence seemed to increase as the participants moved from elementary to high school. In other words, positive experience beginning in early childhood education appears to serve as precondition for building self-efficacy in later grades.

Our study is limited in scope — small number of participants — and it is also short in terms of time. Thus, its conclusions may only apply to the schools and the student population directly involved. However, the study points out a possible direction for future research and scholarship in the area of self-efficacy. We posit that the study of modeling and the forging of earlel

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