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Social Mobility Through Mathematics Proficiency for English Language Learners

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College admission is contingent upon students' high school performances, especially mathematics proficiency that is crucial in qualifying for the projected science, technology, engineering, and mathematics professions of the future. This paper reviews some concerns that hinder the efforts of English language learners (ELLs), often the children of immigrants, to achieve social mobility through a college education. ELLs consistently fail to achieve proficiency on mathematics assessments as measured by the National Assessment for Educational Progress and local assessments such as the Florida Comprehensive Assessment Test. Consequently, many ELLs do not attend college. The article examines implications for educators and policymakers for resolving some of the issues that impede transforming ELLs into academic and societal achievers. Actions taken by educators and policymakers might assist ELLs in navigating the challenges encountered in their pursuit of a college education.

Keywords: *English language learners, mathematics proficiency, social mobility, social change, at-risk learners*

Introduction

Forty million immigrants comprised 13% of the U.S population in 2013, with 85% of those immigrants speaking a language other than English at home (Census Bureau, 2014). Among the immigrant population, children aged 5 to 17 years varied in their English-speaking ability with 29% reportedly speaking English not very well, or not at all (Census Bureau, 2014). As limited-English-proficient immigrant children enrolled in public schools over the years, 10% of that student subgroup needed to learn English to succeed academically (Census Bureau, 2014; National Center for Education Statistics [NCES], 2014). These English language learners (ELLs) represented a plethora of languages other than English with Spanish as the primary language spoken (Batalova & McHugh, 2010).

The National Assessment of Educational Progress (NAEP) conducts a biennial assessment on what American students know and can do in various subjects. The 2013 NAEP revealed that 41% of fourth-grade ELLs, 69% of eighth-grade ELLs, and 86% of 12th-grade ELLs failed the mathematics assessments nationally, compared to 15%, 24%, and 34% respectively for non-ELLs (NCES, 2013).

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Similar performance disparities existed in Florida, where ELLs represented 8.8% of students enrolled in public schools (NCES, 2013). Florida administers the Florida Comprehensive Assessment Test (FCAT) annually to evaluate students' knowledge and skills in Grades 3 to 10. On the 2011 FCAT mathematics segment, 30% Grade 3 ELLs statewide achieved proficiency (Florida Department of Education, 2014). In 2013, the same cohort of ELLs taking the FCAT mathematics segment as fifth graders achieved a 26% proficiency. In 2014, 22% of Grade 6 ELLs statewide achieved proficiency on the FCAT mathematics segment (Florida Department of Education, 2014).

Over the years, American society has generally accepted the premise that a college education predicted beneficiaries of the American Dream. Considering that 63% of all jobs forecasted through 2018 would require some college has supported that premise (Carnevale, Smith, & Strohl, 2013). Attending college implies that students must graduate high school with specific prerequisites. The High School Transcript Study reviews students' high school records to examine course-taking patterns and to predict future education outcomes (NCES, 2013). U.S. high school students must complete a minimum of four credits in English and three credits in mathematics to qualify for a graduation diploma (NCES, 2013). However, 63% of ELLs have failed to achieve those minimum English and mathematics requirements to successfully complete high school, compared to a 25% non-ELLs' failure rate during the same period (NCES, 2013). Furthermore, discussions regarding the importance of science, technology, engineering, and mathematics (STEM) education to the U.S. global stature have resonated among public interests and opinions. The majority of STEM jobs will require a postsecondary degree, with mathematics as the foundation of STEM education (Vilorio, 2014). Unfortunately, a 63% failing rate among U.S. high school ELLs has created challenging barriers for those who pursue upward social mobility through education. ELLs' mathematics scores on standardized assessments locally, nationally, and internationally suggest that multiple factors have collectively hindered ELLs' academic progress and probably their quest for social mobility.

Theoretical Perspectives

Krashen (1981) expounded on the essential role of comprehensible input in second language acquisition. Krashen noted that conditions of high self-confidence, self-esteem, and motivation were fundamental to ELLs processing comprehensible input. Low self-confidence, self-esteem, and motivation created mental blocks that hindered ELLs from processing the comprehensible input needed to acquire language proficiency. Krashen's comprehensible input theory as a precursor to language acquisition is crucial to understanding ELLs' low mathematical performances. Understanding how ELLs acquired a second language might illuminate some of the challenges they have encountered on mathematical assessments administered in English. Learning English as a foreign language has emerged as a major undertaking for both educators and learners, and educators have accepted the challenges associated with helping learners achieve the requisite proficiency for academic achievement. Multiple factors hinder ELLs' mathematics proficiency, including English proficiency, socioeconomic status, gender, mathematics anxiety, and grade level.

English Language Proficiency

Researchers (Beal, Adams, & Cohen, 2010; Orosco, Swanson, O'Connor, & Lussier, 2011) have identified limited English proficiency as a significant predictor of ELLs' low mathematics achievements. Having limited English proficiency skills proposes that ELLs have difficulty interpreting mathematics word problems. Studies (Abedi & Lord, 2001; Martiniello, 2008) support the proposition that the wording of mathematics problems impedes ELLs' comprehension, which ultimately affects their overall performances on assessments. The challenges experienced by ELLs in achieving mathematics proficiency have underscored the critical prerequisite of English proficiency for decoding mathematics word problems. ELLs acquiring English proficiency simultaneously with comprehending English, the language of mathematics instruction, highlights the mammoth challenges faced by this subgroup.

Socioeconomic Status (SES)

Seven million immigrants lived in poverty in the United States during 2013, with children 6 to 18 years old representing 20% of that population (DeNavas-Walt & Proctor, 2014). For the ELLs within this group of immigrants, living in poverty did not automatically designate them as poor performers on mathematical assessments. However, Aikens and Barbarin (2008) observed that ELLs living under middle- to high-SES conditions usually enjoyed greater access to literacy material and had more highly educated parents who actively directed their children's education. Having more highly educated parents was crucial to higher SES ELL students acquiring language proficiency at a faster rate than those ELLs from lower income families (Krashen & Brown, 2005). The faster ELLs acquired language proficiency, the faster they improved academically (Krashen & Brown, 2005). In contrast, children from low-SES backgrounds not only acquired language skills more slowly, but they were prone to reading deficiencies (Aikens & Barbarin, 2008). Reading deficiencies in low-SES children suggested difficulty in comprehending mathematics word problems and a greater dilemma for those learning the English language.

Gender

Results of the 2012 NAEP assessment revealed that average mathematics scale scores for girls and boys were identical (244 points) at the elementary level (NCES, 2013). In previous decades, girls had outperformed boys on every NAEP mathematics assessment from 1973 to 2008 at the elementary level. Boys marginally outperformed girls at the middle and high school levels on each NAEP assessment from 1973 to 2012 (NCES, 2013), with gaps ranging from 2 to 4 points. The NAEP results suggest a linkage between gender and students' mathematics achievement from fourth through 12th grade. Some researchers (Erden & Akgul, 2010; Rosas & Campbell, 2010) have noted that students' attitudes toward mathematics during their K–12 years swayed their choices in mathematics related courses, and by extension, mathematics related careers. Chow and Salmela-Aro (2011) discovered that girls gravitated toward avoiding mathematics studies beyond compulsory education, despite their strong showing in elementary school. Other studies (Lindberg, Hyde, Petersen, & Linn, 2011; Robinson & Lubienski, 2011) confirmed that boys consistently outperformed girls in complex problem solving at the high school level, suggesting why males accounted for 74% of STEM careers (Census Bureau, 2014).

From another perspective, parental predispositions affected their children's mathematics performances. According to a Yee and Eccles (1988) study, parents had higher expectations of their sons' mathematics abilities, than they had for their daughters' abilities. Teachers who endorsed gender stereotypes have also inspired girls to doubt their mathematical abilities (Keller, 2001), while allowing boys to flourish from positive teacher feedback (Chow & Salmela-Aro, 2011). Self-confidence and teacher feedback could easily threaten girls' mathematical performances in general, but more importantly, further complicate the learning process for ELL girls.

Grade Level

Cummins (1979) emphasized the importance of time in ELLs developing two types of language skills: basic interpersonal communication skills and cognitive academic language proficiency (CALP). Cummins explained that ELLs required 2–3 years to develop the basic interpersonal communication skills used in social settings, and 5–7 years to develop the CALP used in academic settings.

Achieving CALP within 5–7 years implies that a kindergarten ELL might not accomplish CALP until he or she had entered the fifth or sixth grade, and after only 4 years of English instruction. The No Child Left Behind Act of 2001 mandated the administration of reading and mathematics assessments to third grade students nationwide, and despite flexibilities granted by the Department of Education to some states, the No Child Left Behind mandate for mandatory assessment at the third-grade level is still enforced. Accepting Cummins' perspective that ELLs required 5–7 years to acquire CALP implied ELLs' vulnerability to academic failure. As asserted previously, ELLs enrolled as kindergarteners must be administered a statewide standardized assessment after receiving only 4 years of English instruction. Subsequently, ELLs' low achievement in mathematics has appeared directly linked to insufficient exposure to English acquisition as the students advanced in grade level. Grade level has predicted ELLs' mathematics scores for a cohort of ELLs as they advanced from third grade to fifth grade (Henry, Nistor, & Baltes, 2014), supporting the proposition that insufficient exposure to English proficiency hinders ELLs' mathematical progress as they advance in grade.

Implications for Social Mobility

Comprehensible input has accelerated English language proficiency (Krashen, 1981), and increased language proficiency has accentuated improvements in mathematics performances (Brown, Cady, & Lubienski, 2011; Martiniello, 2008). As high percentages of ELLs continually struggled with mathematics assessments, acquiring mathematics proficiency emerged as a vital checkpoint to ELLs' social mobility. Examining teachers and policymakers might illuminate avenues that ameliorate ELLs' mathematics achievements and, by extension, their pathway to social mobility.

Implications for Teachers

A plethora of literature confirms the predictive strength of English language proficiency on mathematics proficiency. Mathematics teachers control the comprehensible input of mathematics content in the classroom. Therefore, targeting the source of comprehensible input is a logical contention in the fight to improve ELLs' mathematics achievement and to promote their social mobility. Stakeholders demanding improvements in teacher quality and student achievement have pressured teachers into pursuing opportunities for professional growth. Current educational policies demand higher standards of teacher quality, teaching effectiveness, and student achievement (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009). Therefore, teachers must align their instructional delivery with established standards and current strategies to achieve the improvement demanded. Darling-Hammond et al. (2009) explained that educational improvement necessitated teachers having an insightful knowledge of content, and the pedagogical skills required for teaching content effectively. Mathematics teachers could contribute positively by understanding the requisite needs of ELLs in the classroom, and then convey those needs effectively to increase comprehensible input and improve mathematics outcomes. Teachers of ELLs must embrace an awareness of initiatives required for helping the students scale the barriers that inhibit their path to mathematics proficiency. According to Hill and Ball (2004), mathematics instruction has necessitated an appreciation of mathematics reasoning, a comprehension of mathematical concepts and procedures, and knowledge of how the concepts and procedures connect. Hill and Ball also discovered a strong positive correlation between teachers who inspired high students' mathematics scores and teachers who frequently attended mathematics professional development (PD) sessions. Desimone (2013) observed that teachers who attended PD sessions increased their knowledge and skills, changed their attitudes and beliefs, and applied the new knowledge, skills, and attitudes to improve instructional content and boost student learning. In other words, teachers who attended PD strengthened their capabilities for assuring comprehensible input to students. Most mathematics teachers instruct according to their own experiences as students, thereby escalating the urgency for in-service mathematics PD to eradicate negative formative experiences and promote student success (Even & Ball, 2009). Teachers who attend PD sessions tend to share the new knowledge with colleagues, who benefit from the spillover effect of the discussions (Sun, Penuel, Frank, Gallagher, & Youngs, 2013). Collegiality has illuminated avenues to increased teacher knowledge by dispelling barriers to professional growth and development (Darling-Hammond & McLaughlin, 1995). Collegiality has enhanced collaboration, heightened innovation and enthusiasm, while providing continuous support for teacher professional growth (Shah, 2012). According to Novotná (2009), teaching required a balance between the knowledge of mathematics and the knowledge of teaching mathematics. In other words, the variability between mathematics content and pedagogy warrants continuous teacher PD to maintain and strengthen competencies for fostering successful mathematics performances.

Implications for Policymakers

States articulate the mandates that school boards/districts utilize in governing public schools. Over the years, school boards/districts have developed and approved curricula, and established performance indicators for promoting student achievement. Consequently, effective leadership from school boards/districts suggests a direct association with student achievement.

English language proficiency has a direct relationship with ELLs' academic performances (Abedi & Herman, 2010; Solórzano, 2008), making the education of ELLs' a complex and challenging task for policymakers and educators. Some researchers (Kieffer, Lesaux, Rivera, & Francis, 2009; Pennock-Roman & Rivera, 2011) have argued that allowing accommodations to ELLs' assessments might minimize the influence of extraneous language and more accurately measure content competencies. Considering ELLs' dismal performances on standardized mathematics assessments, school boards/districts might consider modifying how ELLs' proficiencies are measured. Specifically, mathematics assessments should match ELLs' proficiency levels at test time. ELLs perform at multiple levels of English proficiency, ranging from the lowest, Level 1, to the highest, Level 5. Therefore, matching mathematics assessments with English proficiency levels might more accurately reflect ELLs' aptitudes because the two groups of language learners are in completely different stages of second language acquisition.

From a different perspective, elementary teachers have provided the foundation that students need for future mathematics courses, suggesting that flawed input at the elementary level could ruin future mathematics performances for any student. The minimal mathematics requirements for teacher candidates majoring in elementary education have resulted in candidates successfully completing teaching programs despite having mathematics anxieties (Beilock, Gundersen, Ramirez, & Levine, 2009). Preservice teachers have a limited understanding of mathematics, despite the claim that elementary mathematics teachers are the frontline of mathematics instruction (Rosas & Campbell, 2010). Perhaps, school boards/districts might consider staffing elementary classrooms with individuals who have majored in mathematics. After all, elementary school mathematics teachers provide the foundation for future STEM learning, despite teachers' unpreparedness (Epstein & Miller, 2011). A more alarming observation from Epstein and Miller is teachers in most states can pass the licensing exam without successfully passing the math portion of the test.

Teacher candidates in the United States enter teaching programs with a level of mathematical knowledge that is lower than that of teacher candidates in countries that perform higher than the United States. Colleges and universities that offer elementary education degrees might consider revamping their curricula to include additional mathematics courses. Additionally, clinical supervisors with mathematics anxieties execute injustices to preservice teachers because they distort how new teachers view mathematical content. The process might easily nurture a vicious cycle that negatively influences mathematics achievement for all students, but more devastating for ELLs burdened by multiple learning distractions.

Conclusion

High school graduation generally represents the end of formal education for some students, or the gateway to postsecondary education for others. Although attending college does not guarantee anyone access to upward social mobility, it remains a key pathway to its achievement. Julian (2012) discussed data suggesting educational attainment as the primary social benchmark for predicting earnings over a lifetime. Unfortunately, 63% of the children of immigrants with limited English proficiency have failed to achieve the minimum mathematics requirements for successfully completing high school. Considering that more than half of all jobs forecasted through 2018 would require some college highlights the importance of improving ELLs' mathematics performances. ELLs low mathematics proficiencies restrict their potential for upward social mobility through a college education. Therefore, improvements in mathematics performances might increase the numbers of ELLs graduating from high school, or their eligibility for entering college. Educators and policymakers have no control over some factors that hinder ELLs' academic progress, but they do control what ELLs learn and how they learn. Focusing on improving teacher quality, modifying ELLs' assessments, and revamping preservice teacher programs might increase ELLs' mathematics achievements, while reinforcing their resolve to pursue upward social mobility through a college education.

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