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Reading and Mathematics Elementary School Performance of Spanish-speaking Children Matriculating from a Bilingual Preschool

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Abstract

The Charlotte Bilingual Preschool (CltBP), situated in the 17th largest urban area of the US, has found itself at the intersection of its community's agendas to provide high quality preschool services to Spanish-speaking families, improve opportunities for upward mobility, and foster literacy gains for children from birth through third grade. This study seeks to determine if the preschool's bilingual approach has any impact on its alumni students' reading and mathematics performance in kindergarten, first, and second grade. DIBELS and MAP testing, as well as standards-based grades, were compared between CltBP alumni and their identified Hispanic peers within the public school system. Findings show that CltBP alumni not only score ahead of their peers in reading and mathematics upon entering public school kindergarten, this advantage continues through second grade. Despite this advantage, many CltBP alumni still continue to perform below state-identified proficiency levels.

Keywords: bilingual, dual language, preschool, Spanish-speaking students, Latino students, early education, early literacy, early mathematics, upward mobility

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[1] Jennifer Morrison served on the Charlotte Bilingual Preschool's Board of Directors from 2013-2020. All research conducted was independent of the Board of Directors and fell within her purview as a researcher at University of South Carolina.

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Introduction

Overview and Purpose of the Study

The Charlotte Bilingual Preschool (CltBP)[2], located in Charlotte, North Carolina, has been engaged in a research project in conjunction with faculty from the University of South Carolina and the University of North Carolina at Charlotte. The purpose of this study is to glean the degree of academic and social readiness its alumni students present as they enter and progress through kindergarten, first, and second grade (see Figure 1). It also seeks to determine the degree of parental preparation the preschool has provided to allow parents to serve as supporters and advocates for their children's education. In order to do this, the research team established two prongs for the study. The first prong is quantitative and compares CltBP student performance on DIBELS[3] and MAP[4] assessments and report card achievement data with the general performance of Hispanic[5] students enrolled in Charlotte-Mecklenburg Schools (CMS). The second prong is qualitative and seeks to determine the degree to which CltBP alumni are prepared to work in English-dominant settings and interact appropriately with peers and teachers on a socio-emotional level. This second prong also seeks to consider the degree to which parents are positioned to advocate for and support their children in the first three years of traditional schooling. This article addresses the findings of the quantitative prong of the larger study, which was specifically guided by the following research questions:

(1) Are children who complete the CltBP program at the same readiness level academically as their peers when they enter kindergarten?

(2) Do these readiness levels endure into first and second grade?

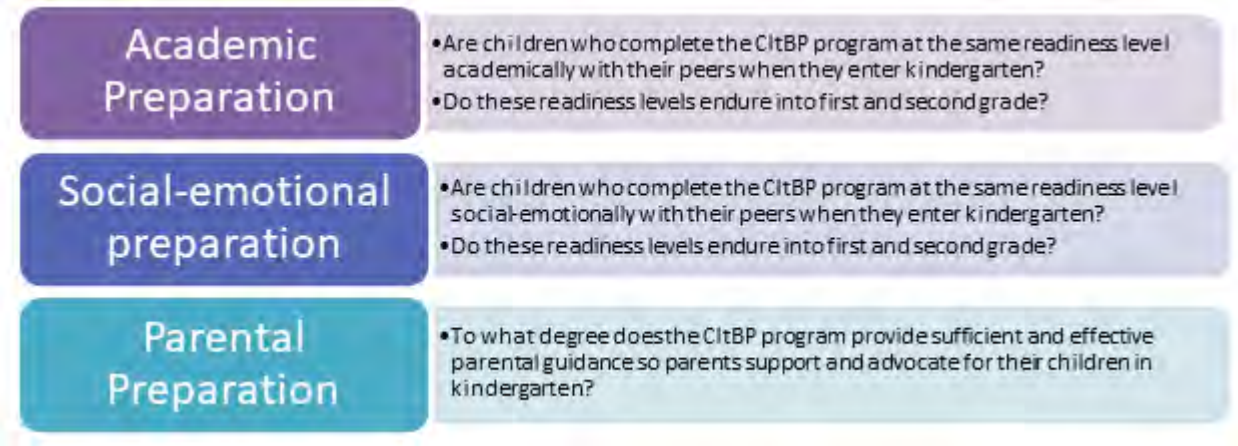
[2] The Executive Director and Board of Directors Chairperson have granted permission to the authors to use the preschool's name.

[3] DIBELS is the Dynamic Indicators of Basic Early Literacy Skills test administered at the beginning and end of each school year.

[4] MAP tests are Measures of Academic Progress in reading and math given to students in the fall and spring each year. Data is comparative across time from winter to winter or spring to spring.

[5] *Hispanic* is the term used by the CMS district for this population of any student of Latin American ethnicity. We will use this term only when referring to the district categorization and its data.

Figure 1. Research questions for alumni tracking project (larger study)



The Charlotte Bilingual Preschool (CltBP) is located in the urban center of Charlotte, NC. Charlotte is a city in the southeastern United States consisting of almost a million inhabitants with a rapidly growing economy. The population of CltBP is comprised of 144 children aged 3-5 from Spanish-speaking families. These families are also at high risk for poverty.

For the purpose of this article, we wish to clarify that Charlotte is the urban center, however the school system and government entities are inclusive of Mecklenburg County, which encompasses the urban center. We will therefore refer to Charlotte-Mecklenburg as the larger, comprehensive area, which, together constitute the 17th largest urban center in the country. We also recognize that CltBP's demographic can be identified by a number of terms. CMS, in its data collection, classifies this population as *Hispanic*, as designated by the US Department of Education. We recognize this term is not ideal and not preferred by the Latino community; however, we have chosen to use it in discussing the data we collected and analyzed in order to maintain consistency with the public data set. In all other references, we have chosen to use the term *Spanish-speaking* because it is descriptive of CltBP's population and preferred by the individuals about whom we are referring.

Background and Context for the Study

In 2014, Chetty et al. published a seminal study on intergenerational upward mobility that examined three features: 1) joint distribution of parent and child income at the national level (i.e., the child's expected income based on parental income); 2) geographic location; and 3) factors correlated with upward mobility including less residential segregation, greater

income equality, better primary schools, greater social capital, and greater family stability. Through a series of metrics, the authors used these features to measure intergenerational mobility in what they called "commuting zones" (CZ)—essentially metropolitan areas across the US—based on the degree to which children's social and economic opportunities depend upon their parents' income or social status. Of the 50 CZs the researchers ranked across the United States—including New York City, Los Angeles, Cleveland, Tampa, New Orleans, and Detroit—Charlotte ranked last with only a 4.4% chance that children whose families are in the bottom quintile of national income distribution could reach the top quintile (Chetty et al., 2014)[6].

This report served as a "wake-up call" for the Charlotte-Mecklenburg community (Leading on Opportunity, 2017, p. 1). This was a metropolitan area which had been recently ranked as the 14th best place to live in the country by *US News and World Report*. However, the Chetty, et al. (2014) study, followed soon by the highly publicized police shooting of Keith Lamont Scott and subsequent fatal riots, caused the city to engage in significant self-reflection regarding the "stark racial, ethnic, and economic divides that exist in our community but are rarely openly discussed" (Leading on Opportunity, 2017, p. 1). The community decided action was needed and formed the Leading on Opportunity Task Force to investigate why the odds for moving out of poverty were so low for children born in the Charlotte-Mecklenburg area and to develop a plan of action to change the situation.

In their report, the Leading on Opportunity Task Force (2017) identified three key determinants for social capital and subsequently the ability to be upwardly mobile: family and child stability, early care and education, and college and career readiness. Two factors, structural segregation/racism and social capital, cut across these three determinants. Segregation was seen to substantially suppress opportunity; social capital was seen to dramatically increase it. The subsequent plan of action called for high-quality early care and public pre-kindergarten programs for children birth to age five that not only allow parents to seek, secure, and retain employment, but also help to build strong early brain development and provide support for early learning, particularly reading proficiency. Important to this study is the report's specific recommendation to "increase enrollment of young Latino[7]

[6] While we recognize Chetty et al.'s work has been challenged (see e.g., Mazumder, 2015), we are not addressing its validity here. Instead, we seek to merely acknowledge the report was used as a compelling impetus by the Charlotte-Mecklenburg community to launch the Leading on Opportunity Task Force.

[7] *Latino* is the term used by the Leading on Opportunity Task Force in its report, and we have retained the integrity of this report's language in our article.

children in quality childcare and public and private pre-K education programs" because, as the task force acknowledged, there are perceived and real barriers that limit enrollment of Latino children in licensed care or preschool, and they "may be missing out on opportunities to adequately prepare for success in kindergarten and beyond" (p. 21). This was a focus of the task force because statistical data show that in 2019 almost 12% of Charlotte-Mecklenburg's overall population speaks Spanish as their dominant language, and the percentage continues to increase (Data USA, 2019).

Within this context, the Charlotte Bilingual Preschool has subsequently found itself at the intersection of many desires to address long-standing social and economic inequities that continue to evolve within a rapidly changing population demographic. As one of the few entities within the Charlotte-Mecklenburg community that provides high-quality early learning opportunities[8] for Spanish-speaking families, it has garnered significant attention since publication of the Opportunity Task Force's report. While interest in its early childhood program has been significant, the preschool's family support program—which provides families with parenting, life skills, computer, and English-language classes, enabling them to sustain and nurture their children's educational and emotional development (https://www.bilingualpreschool.org/mission/)—has also been spotlighted. As the school has gained significant recognition and other entities have sought to replicate CltBP's model, questions have been asked about what makes the school successful, the "special sauce" so to speak: Is it the dual language/bilingual instruction? The integration of family programs? The asset-based approach? And if what appears to be success with Spanish-speaking children and their families actually has substance, is the program as successful as it appears to be? We aim to attempt to answer the latter question through this study.

Literature Review

With our research questions in mind, we reviewed the academic literature to identify where our study enters conversations about bilingual early childhood education. Our literature review is divided into four subsections to address the intersections of key components of our research study: relevance of preschool education for kindergarten

[8] "High-quality" is determined by CltBP's five-star rating by the North Carolina Division of Child Development

readiness with specific focus on students at risk; definitions of bilingual education to understand why the CltBP population is categorized as "students at risk"; the importance of bilingual education; and the impact bilingual education has on school readiness and performance.

Early Childhood Education for Students at Risk

Early childhood education provides preparation for the demands of formal schooling: classroom behavior, early literacy, and access to modeled language acquisition. It also promotes the development of social-emotional competencies through the children's interaction with peers and adults. In a study about preschool impact in North Carolina, Dodge et al. (2017) found high-quality preschool education is associated with improved reading and mathematics performance as evaluated through standardized exams in elementary school, reduced misplacement in special education, and reduction in grade retention in grades 3, 4, and 5. Such benefits have a direct positive impact on preschool programs' alumni and indirect effects on their peers. Muschkin et al. (2020) add that the improvement is even more significant for children of low-income families, and "it is likely spillover benefits contribute to improved classroom environments in the elementary grades, when children are in classes with peers who are better prepared for school" (p. 402). The substantial impact of preschool education appears beyond kindergarten and potentially increases through fifth grade. These studies suggest that investments in early education "actually lead to a trajectory of growing impacts across development, if implemented in the right context" (Dodge et al., 2017, p. 1011). Therefore, programs that provide quality early childhood education promote equality, helping to bridge the achievement gap for young learners at risk.

Bai et al. (2020) confirm the findings of particular benefits for students from economically disadvantaged backgrounds, as early-childhood education in high-quality preschool programs have long lasting effects that can be observed through eighth grade. Such findings of the advantages of preschool education are also observed outside the US In Canada, for example, preschool programs benefit children in extreme and working poverty (Polyzoi et al., 2020). Historically, low socioeconomic status, disabilities, and linguistic diversity represent risk factors for low academic achievement. The achievement gap for low-SES Spanish speakers in the US starts in the preschool years and is noticeable in their literacy and math readiness skills at kindergarten entry (Lindholm-Leary, 2014). However, high quality

early childhood education reduces that risk by promoting early attainment of language and literacy development, communicative skills, and school readiness.

The studies cited in this subsection indicate the relevance of early childhood education for students at risk, which is the case of the CltBP population based on their socio-economic status and linguistic diversity. However, this literature is about general early childhood education for all students regardless of their home language. That is, it seems that any student can benefit from high-quality early childhood education. Therefore, it is necessary to review the literature not only focused on high-quality early childhood education but also on such education aimed at bilingual learners.

Defining Bilingual Education

Bilingual education is an umbrella term to identify academic instruction provided in two languages promoting bilingualism (spoken language) as well as biliteracy (written language). Depending on their instructional philosophy and goals, educational institutions may choose to implement bilingual education in multiple ways (Wagner & King, 2012).

Dual language programs in the US provide instruction in English as well as in the target language at various percentage models (for example, 50% in the target language and 50% in English or 30% in the target language and 70% in English); each language is assigned to specific independent tasks or subjects during the instructional time. Students may have monolingual classes in English for language arts and social studies, and then monolingual classes in Spanish for science and mathematics. The exposure to the two languages may or may not be balanced, and teachers tend to require students to use only one language at a time. Two-way immersion programs, which is one format of dual-language instruction, integrate native speakers of both target languages so students negotiate their process of meaning making in authentic social interactions (Wagner & King, 2012).

Bilingual education often supports the home language while also providing instruction in another language, allowing students to use their full linguistic repertoire in the school setting. However, research shows even well-meaning dual language programs can privilege English over the target language due to pressure from the community and stakeholders (Oliveira et al., 2020). This happens when English language learning receives more attention, occurs at a higher percentage, or assumes a higher status than the target language. In their study on equity in bilingual education, Oliveira et al. (2020) reiterate it is important to

consider not only the status of each language, but also the linguistic status of the learners. They argue that learners show resistance in the face of linguistic inequality and thrive when their voices are heard. In the case of CltBP, the dual language program elevates the status of Spanish language among their faculty, staff, and student body through family engagement and community partnership initiatives and by providing 50% of the instructional time in each language. This balanced model prepares the students to enter kindergarten classrooms where English is the dominant language, while also strengthening their skills in and building efficacy through their home language.

From the perspective of translanguaging and transliteracies, as defined by García and Wei (2014), bilingual students can engage in writing (or any communicative event for that matter) for various purposes: expressing pride, connecting with diverse audiences, constructing their identities, and co-constructing meaning (Machado & Hartman, 2019). In their study of third-graders, Pacheco et al. (2019) defend the translingual pedagogies their participants began in their early years of education. Teachers are called to recognize and develop their own translingual competencies to support students' bilingualism at its full potential. In the case of CltBP, students alternate between English- and Spanish-dominant days. On one day students learn in Spanish, which is their home language, and on the next day students learn in English, the target language. Additionally, all materials of instruction are provided in both languages, and each classroom has two teachers—one who speaks predominantly Spanish with the children and one who speaks predominantly English. This approach is aligned with the concept of *additive schooling* as it "builds on and extends the social, cultural, and linguistic assets brought by multilingual diverse students populations, and aims to prepare bicultural and bilingual students to negotiate their complex worlds" (Bartlett & García, 2011, pp. 21-22).

The Importance of Bilingual Instruction

Several scholarly fields—education, psychology, anthropology, sociology, communication disorders, neurosciences, and linguistics among others—have studied bilingualism and multilingualism in the early years of language acquisition and in early education. Bilingualism is not a rare phenomenon; in fact, most of the world's population grows up in bilingual environments. Multilingualism is predominant in almost every society across age groups, ethnic groups, and socioeconomic spheres (Saville-Troike, 2012). It is

relevant, though, to discuss the effects of bilingual early education in the United States because of the insularity of the country. Nieto (2013) attributes such insularism as a result of the sheer size of the country, the traditional dominance of English language, the geographic distance from other countries where other languages are dominant, and language ideologies that often privilege monolingualism. We also have to consider the societal stigmas attached to individuals not speaking English (Oliveira et al., 2020).

Bilingual education has powerful benefits that extend from cognitive development to socio-cultural inclusion. In the long run, bilingualism increases attention levels, reading skills, intercultural understanding, empathy, and academic achievement, and in advanced ages, it reduces the cognitive decline caused by dementia (Bialystok, 1997; Comishen et al., 2019). Although there is debate about the optimal age and form of input for learning a second language (Paradis et al., 2016), there is no doubt that early exposure to an additional language facilitates the natural acquisition of pronunciation, vocabulary, and grammatical structures. Fostering emergent bilingualism in preschool brings long-term advantages.

Multidisciplinary research indicates that bilingualism, and thus bilingual education, has an impact on a variety of brain functions (Costa, 2020). Mohr et al. (2018) explain that children develop stronger brain functions involving memory, attention, and awareness when they are immersed in two or more languages and even more when they are directly instructed in those languages. Beyond the linguistic and cognitive dimensions, exposure to various languages in early childhood also promotes the development of socio-cultural competencies (Nicoladis & Genesee, 1996). In other words, bilingual children have the potential to develop better communication skills not only because they know how to use their words, but because they know how to navigate between various socio-cultural scenarios. All of these benefits are desirable functions and behaviors identified as readiness in school settings.

Bilingualism and its Impact on School Readiness and Performance

School readiness is a complex construct and requires a comprehensive set of skills that go beyond logical reasoning and literacy development. Hartman et al. (2017) refer to the importance of school readiness for low-income and ethnically and linguistically diverse children because those are the populations at higher risk for low academic achievement and behavioral concerns. Improving students' language skills from an early age seems to have an impact on the students' overall behavior in the classroom, which in turn enhances their

cognitive skills and academic performance. The researchers claim that among the English language learner (ELL) population in US schools, those who have stronger home-language skills present more positive behavior skills and school readiness than their counterparts who were forced to assimilate into the dominant English-speaking culture by having their heritage language suppressed. When students have gained the behavior skills expected in kindergarten, that behavior has a positive impact not only on the individual student but also on the whole-class outcomes (Hartman et al., 2017; Muschkin et al., 2020). These results were more clearly demonstrated by teacher assessments than the standardized testing, yet standardized tests also showed statistical relevance (Hammer et al., 2017; Hartman et al., 2017).

Lindholm-Leary (2014) investigated the impact of instructional language and primary language proficiency in the academic outcomes of students in kindergarten, first, and second grade, and she highlights the advantages of bilingual education for low-income Spanish speakers not only in preschool but also through first grade. Despite the pressure toward English-only education, bilingual education and strong foundations in the home language in preschool is directly related to language- and literacy- as well as math-readiness in kindergarten and subsequent years. In her study, Lindholm-Leary found students taught primarily in English in preschool present strong literacy- and math-readiness in kindergarten. Nevertheless, the focus on English language causes language attrition, and the gap for bilingual students becomes more prominent in subsequent years. The students who receive bilingual education in preschool, on the other hand, surpass their English-dominant bilingual peers in first and second grade. Calderón et al. (2011) explain that "it is easier to build a strong foundation with quality programs in preschool to the third grade, when children's needs are much more manageable and teachers are imparting new skills rather than remediating gaps" (p. 119). They also agree that supporting the primary home language has a positive impact on how children learn language, literacy, and other academic content. Tazi (2014) reinforces this idea through findings that Spanish-speaking kindergarteners who received bilingual education achieved better ratings in developmental skills and school readiness than their counterparts who received English-only instruction.

These studies support the investment in bilingual instruction in preschool and continuing at least through second grade because it fosters the development of stronger foundations in English as well as in the family's primary language. Because of the importance of high-quality bilingual education to improving student academic achievement, we sought to

determine the degree to which CltBP's program has provided lasting instructional effects with its students. To this end, we draw from program evaluation study design informed by the summative evaluation of the Content, Input, Process, and Product (CIPP) Model (Stufflebeam, 2003) and program evaluation guidelines (Fitzpatrick et al., 2004). CIPP information was used retrospectively to sum up the program's merits, worth, probity, and significance. The goals, priorities, problems, processes, and outcomes of the program were assessed with a comparison to the targeted needs of the beneficiaries due to the lack of a critical competitor in the region. For comparison purposes, we located a comparable sample of students with similar academic and ethnographic background.

Methods

This study analyzes data provided by Charlotte-Mecklenburg Schools to investigate if CltBP Spanish-English bilingual alumni present similar academic readiness levels in kindergarten as their Hispanic, public-school peers. We also investigate if they maintain those levels throughout first and second grades. In this section, we present a description of the participants, context, data collection methods, and data analysis procedures. In order to preserve confidentiality for students and families, we have de-identified the years of CltBP and CMS enrollment as well as the CMS school locations. Instead, we refer to them as cohorts with Cohort 3 being the most recent of the three groups studied to move through K-2nd grade.

The sample consists of 68 CltBP alumni and 9933 students identified as Hispanic in grades K-2 of Charlotte Mecklenburg Schools (CMS) who did not attend CltBP. Of the 68 CltBP alumni, 21 (30.9%) started kindergarten as Cohort 1, 21 (30.9%) started kindergarten as Cohort 2, and 26 (38.2%) started kindergarten as Cohort 3. Of the 9933 non-CltBP alumni, 3252 (32.7%) started kindergarten as Cohort 1, 3396 (34.2%) started kindergarten as Cohort 2, and 3285 (33.1%) started kindergarten as Cohort 3. The distribution of grade levels across the two groups of students is not statistically significantly different from each other, $\chi 2$ (df =2) = 0.83, p = .66, which suggests that the CltBP sample is comparable to the Hispanic population with regard to grade distribution.

To attain our data, we obtained consent, provided in Spanish and with explanation, from all CltBP families. This included the students' public school district ID numbers. We then gave these ID numbers to CMS to extract data belonging to these CltBP alumni from its

databases. Next, we used aggregated, public performance data to compare CltBP students with non-CltBP Hispanic students within CMS.

Data Sources

Dynamic Indicators of Basic Early Literacy Skills. DIBELS assessments are a set of short (approximately 1 minute) measures and procedures designed to assess the acquisition of early literacy skills in an ongoing, regularly monitored process. DIBELS have excellent technical adequacy (see Fuchs et al, 2004; Goodman, 2006; Hintze et al., 2003; Patterson et al., 2013; Speece et al., 2003; Vadasy et al., 2005).

Measures of Academic Progress. MAP is a series of computerized, adaptive tests that measure student knowledge and skills in reading, mathematics, language usage, and science. They can be administered to students in grades K-12 three times per year in the fall, winter, and spring. Reliability and validity of Measures of Academic Progress (MAP) is documented by the Northwest Evaluation Association (2004).

Grades. The subject areas evaluated included mathematics and reading. Mathematics and reading skills are measured by tasks listed in Table 1. Students' grades were assessed by their classroom teachers four times a year (each quarter of the academic year): 1 = not meeting grade-level standards; 2 = progressing toward grade-level standards, 3 = meet grade-level standards; and 4 = exceeds grade-level standards. Average scores of kindergarten students across four quarters in the first year of school were used to represent their achievement in reading and mathematics, respectively. For the purpose of this study, quarterly grades were averaged and used to represent reading and mathematics achievement, respectively. This comparison consisted of 30 CltBP alumni and 4575 students identified as Hispanic and enrolled in kindergarten in CMS.

Table 1

Quarterly teacher grade evaluation skill criteria in reading and mathematics

Reading Skills	Math Skill Criteria
Phonics and word recognition integration of knowledge and ideas	Analyzes, compares, creates, and composes shapes
Range of reading and level of text complexity	Identifies and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres)
Key ideas and details	Classifies objects and counts the number of objects in each category
Comprehension and collaboration	Describes and compares measurable attributes
Presentation of knowledge and ideas	Understands addition as putting together and adding to, and understands subtraction as taking apart and taking from
Print concepts	Compares numbers
Phonological awareness	Counts to tell the number of objects
Fluency	Knows number names and the count sequence
Text types and purposes	Describes and compares measurable attributes
Production and distribution of writing	Works with numbers 11–19 to gain foundations for place value
Conventions of standard English	
Vocabulary acquisition and use	

Data Analytical Procedure

Independent sample t-tests were used to compare the academic growth in reading and mathematics of these two groups of students measured by MAP. A mixed-design analysis of variance (also known as a split-plot ANOVA) was employed to compare the reading and mathematics proficiency between the two groups of students at the beginning, middle, and end of the academic year. Multivariate analysis of variance (MANOVA) was employed to compare the reading and mathematics grades received from kindergarten teachers in reading and mathematics.

Results

Charlotte Bilingual Preschool alumni were compared with other Hispanic students in K-2 in Charlotte Mecklenburg Schools with respect to their performance in Dynamic Indicators of Basic Early Literacy Skills (DIBELS), Measures of Academic Progress (MAP), and teacher-assessed grades in reading and mathematics.

DIBELS

Comparisons between the CltBP alumni and non-CltBP alumni on the performance on DIBELS were conducted with mixed Analysis of Variance (ANOVA) where groups (CltBP versus non-CltBP) were treated as the independent variable and time (Beginning of the Year, Middle of the Year, and End of the Year) was treated as the within-group factor. We used effect sizes (small = .02; medium = .06; large = .14) to document practical significance of obtained differences (Cohen, 1988). Table 3 presents the descriptive statistics of the DIBELS outcomes by group and time.

Table 2

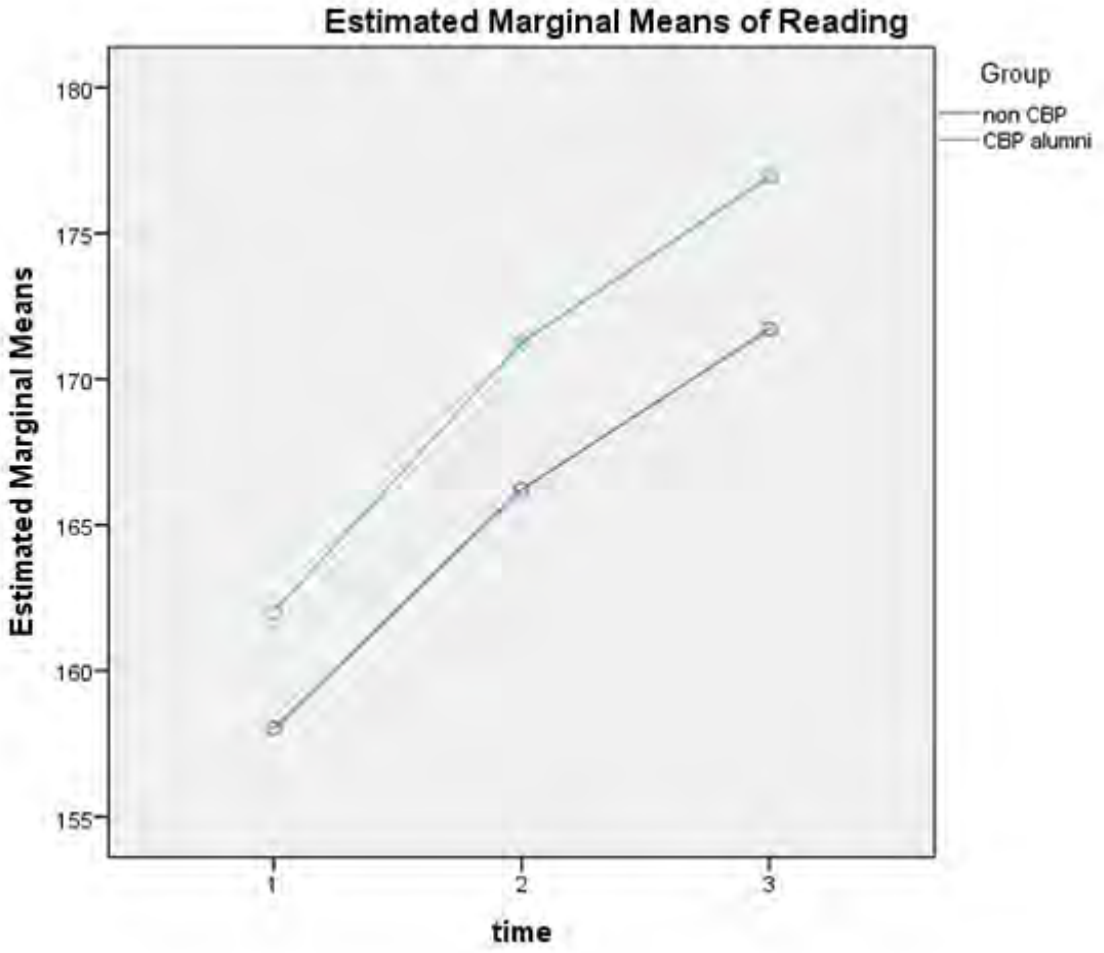
DIBELS test comparisons: Means and Standard Deviations (in parenthesis)

		Reading		Mathematics	
		CltBP	Non-CltBP	CltBP	Non-CltBP
Cohort 1	Beginning of the year	139.95 (8.48)	139.12 (9.75)	137.70 (10.41)	135.25 (11.36)
	Middle of the year	145.26 (9.66)	145.47 (10.48)	144.80 (11.96)	142.03 (12.17)
	End of the year	153.42 (9.88)	153.50 (11.54)	156.85 (9.85)	152.39 (13.00)
Cohort 2	Beginning of the year	148.95 (14.26)	146.34 (15.31)	147.59 (17.31)	144.16 (17.02)
	Middle of the year	156.67 (14.58)	154.94 (15.86)	158.54 (18.49)	154.08 (18.08)
	End of the year	165.77 (15.55)	162.09 (15.99)	168.66 (17.56)	162.95 (17.68)
Cohort 3	Beginning of the year	162.03 (21.11)	158.04 (19.45)	160.23 (22.44)	158.21 (20.96)
	Middle of the year	171.26 (21.44)	166.22 (19.51)	169.11 (22.08)	167.35 (20.77)
	End of the year	176.95 (18.50)	171.72 (19.07)	175.40 (22.86)	174.04 (19.57)

Reading Cohort 3

There was no statistically significant interaction effect between the groups and the growth, F (2, 4942) = 0.17, p = .85, partial η2 < .001 (small effect). However, both CltBP and non-CltBP alumni showed a statistically significant growth from beginning to the end of the year, F (2, 4942) = 105.06, p < .001, partial η2 = .04 (medium effect). The growth was linear (see Figure 2), F (1, 2471) = 180.30, p < .001, partial η2 = .07 (medium effect).

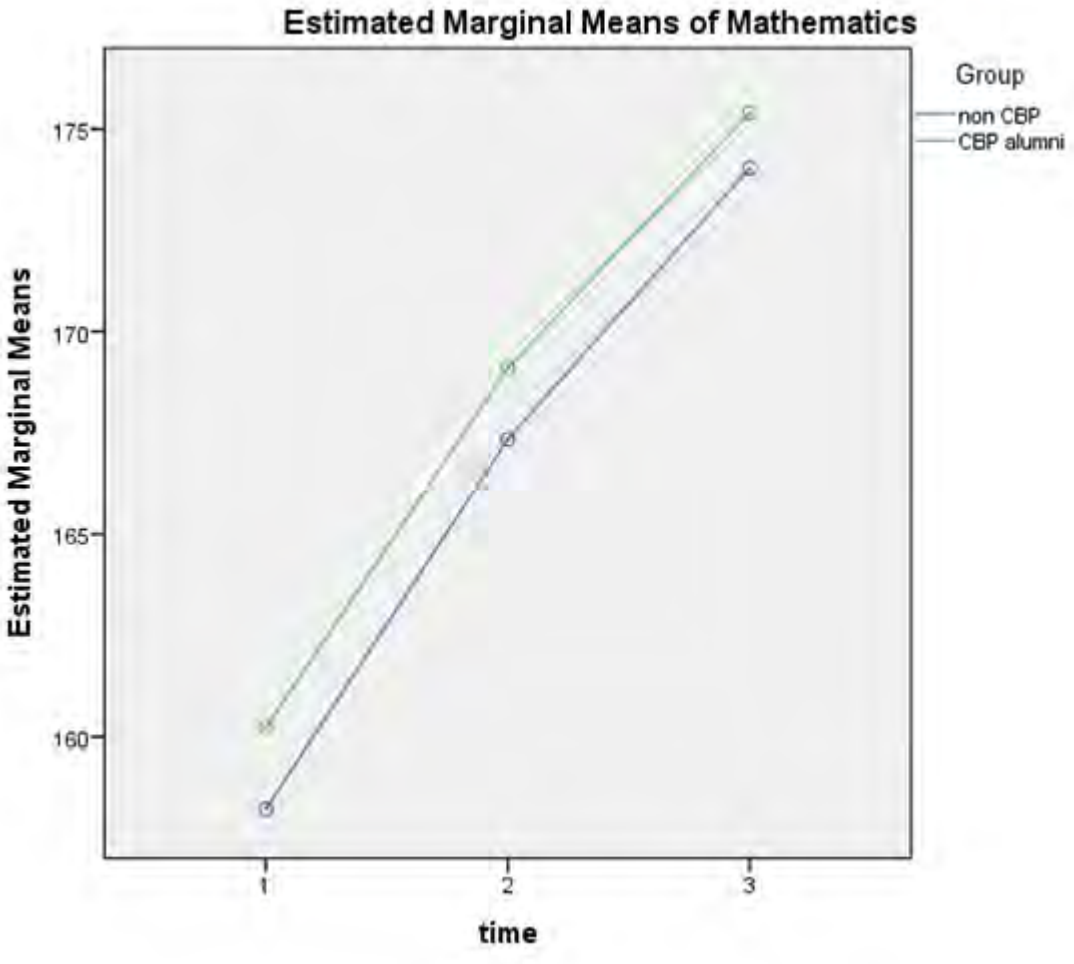
Figure 1. Interaction between group (CltBP versus Non-CltBP) and time (Beginning, Middle, and End of the Year) for reading measured in DIBELS of Cohort 3 (Kindergarteners)



Mathematics Cohort 3

There was no statistically significant interaction effect between the groups and the growth, F (2, 4978) = 0.67, p = .51, partial η^2 < .001 (small effect). However, both CltBP and non-CltBP alumni showed a statistically significant growth from beginning to the end of the year, F (2, 4978) = 193.52, p < .001, partial η^2 = .07 (medium effect). The growth was linear, F (1, 2489) = 322.77, p < .001, partial η^2 = .02 (small effect). There was also a quadratic trend in the growth, F (1, 2489) = 8.54, p = .004, partial η^2 = .003 (small effect). The quadratic trend (Figure 3) indicates that the growth from the middle of the year to the end of the year is faster than that from the beginning of the year to the middle of the year for both groups.

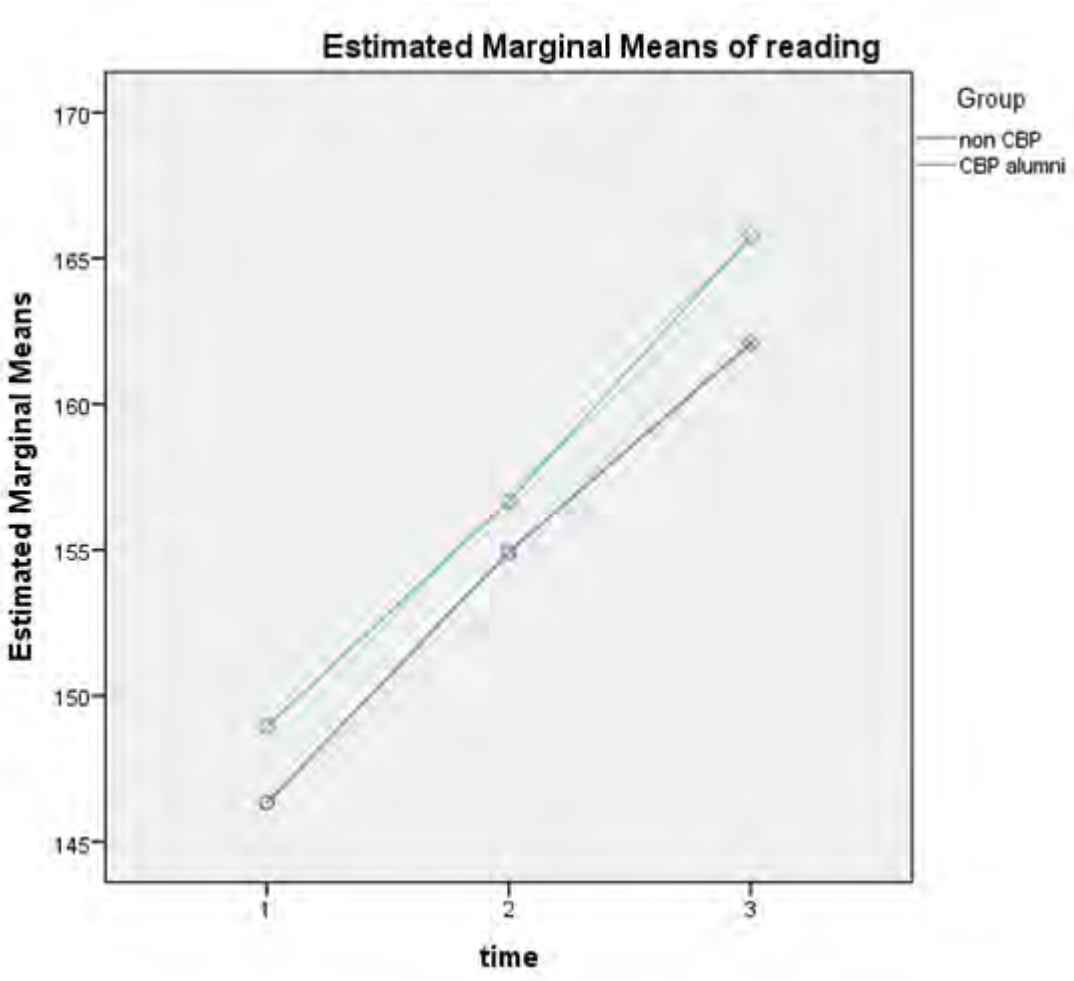
Figure 2. Interaction between group (CltBP versus Non-CltBP) and time (Beginning, Middle, and End of the Year) for mathematics measured in DIBELS of Cohort 3 (Kindergarteners)



Reading Cohort 2

There was no statistically significant interaction effect between the groups and the growth, F (2, 10404) = 1.11, p = .33, partial η^2 < .001 (small effect). However, both CltBP and non-CltBP alumni showed a statistically significant growth from beginning to the end of the year, F (2, 10404) = 307.52, p < .001, partial η^2 = .06 (medium effect). The growth was linear (Figure 4), F (1, 5202) = 514.71, p < .001, partial η^2 = .09 (medium effect).

Figure 3. Interaction between group (CltBP versus Non-CltBP) and time (Beginning, Middle, and End of the Year) for reading measured in DIBELSof Cohort 2 (1st graders)

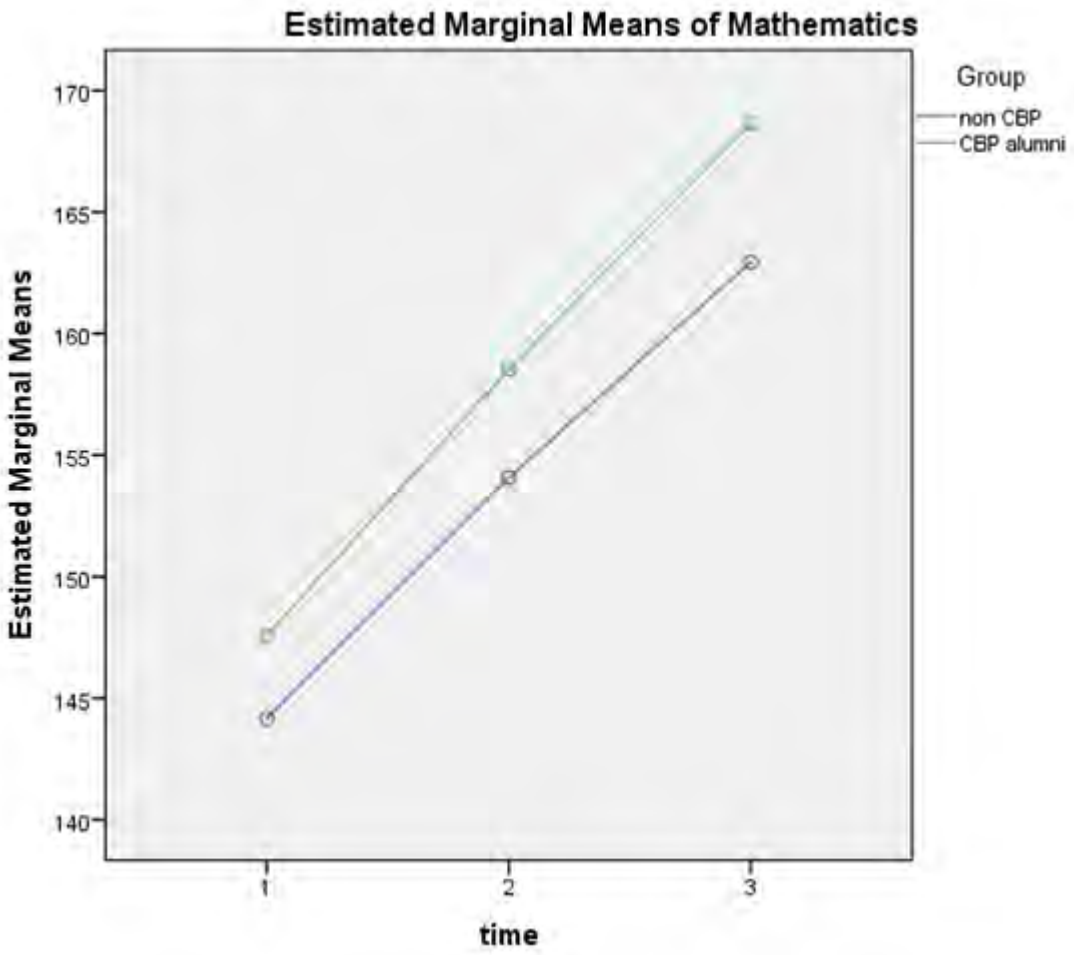


Mathematics Cohort 2

There was no statistically significant interaction effect between the groups and the growth, F (2, 10448) = 1.55, p = .21, partial η^2 < .001 (small effect). However, both CltBP and non-CltBP alumni showed a statistically significant growth from beginning to the end of the year, F

(2, 10448) = 468.67, $p < .001$, partial $\eta^2 = .08$ (medium effect). The growth was linear (Figure 5), F (1, 5224) = 777.65, $p < .001$, partial $\eta^2 = .13$ (medium effect).

Figure 4. Interaction between group (CltBP versus Non-CltBP) and time (Beginning, Middle, and End of the Year) for mathematics measured in DIBELS of Cohort 2 (1st graders)

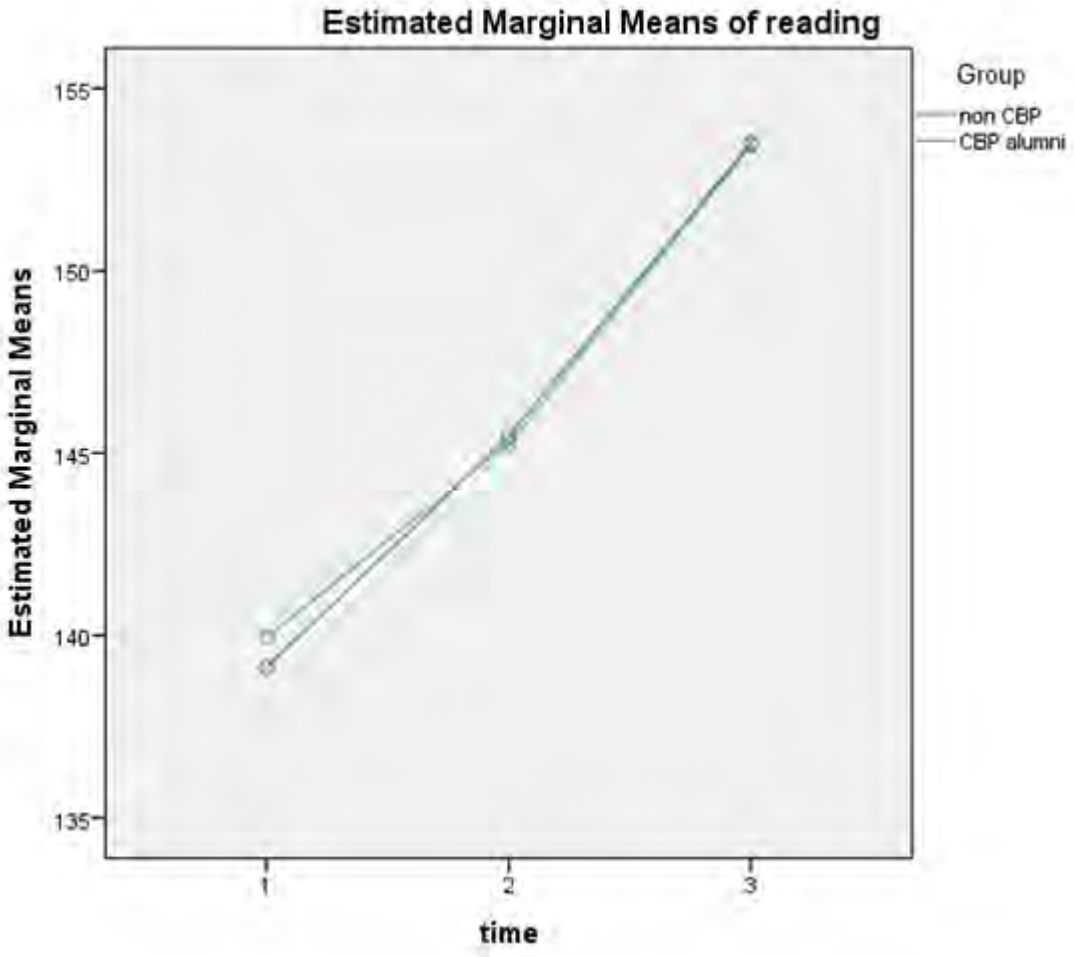


Reading Cohort 1

There was no statistically significant interaction effect between the groups and the growth, F (2, 10206) = 0.48, $p = .62$, partial $\eta^2 < .001$ (small effect). However, both CltBP and non-CltBP alumni showed a statistically significant growth from beginning to the end of the year, F (2, 10206) = 222.12, $p < .001$, partial $\eta^2 = .04$ (medium effect). The growth was linear (Figure 6), F (1, 5103) = 376.54, $p < .001$, partial $\eta^2 = .07$ (medium effect). There was also a quadratic trend in

the growth, F (1, 5103) = 8.22, p = .004, partial η^2 = .002 (small effect). The quadratic trend (Figure 6) indicates that the growth from the middle of the year to the end of the year is slower than that from the beginning of the year to the middle of the year for both groups.

Figure 5. Interaction between group (CltBP versus Non-CltBP) and time (Beginning, Middle, and End of the Year) for reading measured in DIBELS of Cohort 1 (2nd graders)

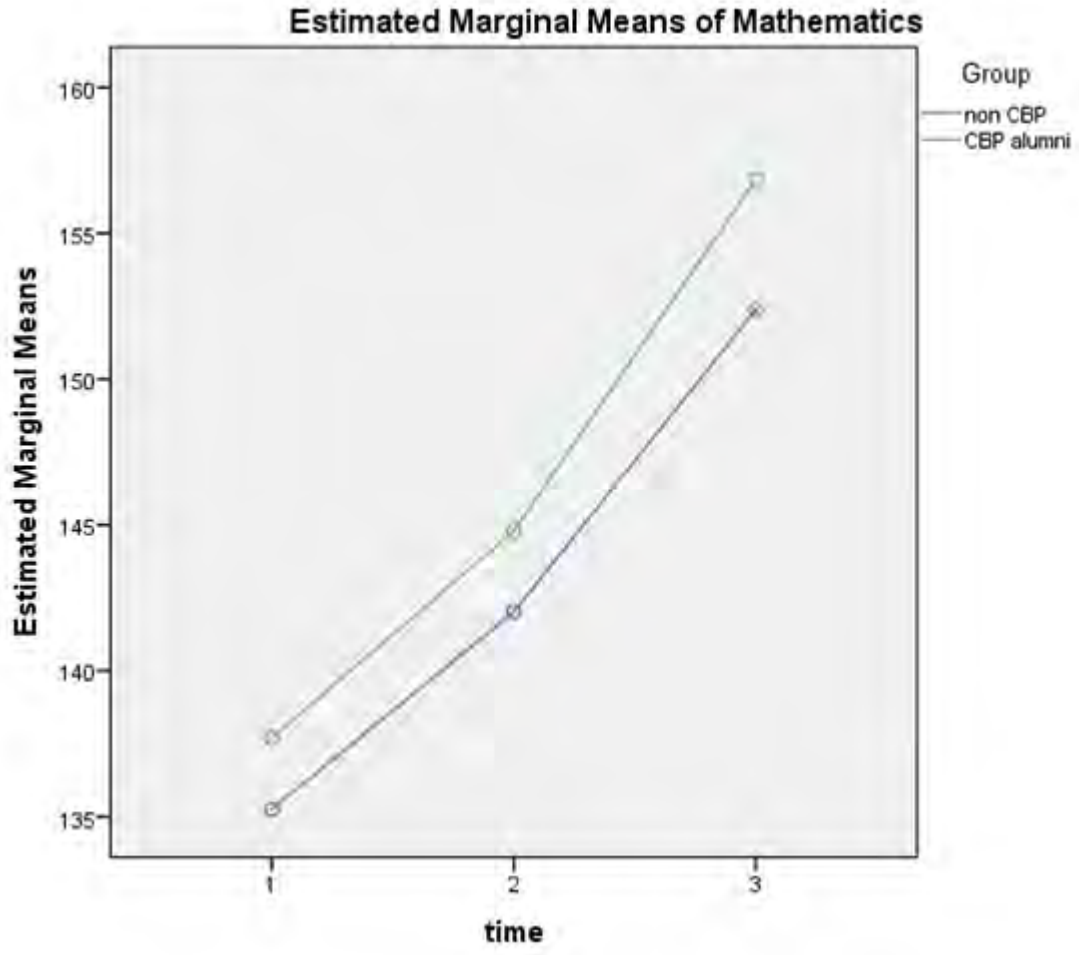


Mathematics Cohort 1

There was no statistically significant interaction effect between the groups and the growth, F (2, 10920) = 0.15, p = .87, partial η^2 < .001 (small effect). However, both CltBP and non-CltBP alumni showed a statistically significant growth from beginning to the end of the year, F

(2, 10920) = 319.35, $p < .001$, partial $\eta^2 = .06$ (medium effect). The growth was linear, F (1, 5460) = 506.16, $p < .001$, partial $\eta^2 = .09$ (medium effect). There was also a quadratic trend in the growth, F (1, 5460) = 7.37, $p = .007$, partial $\eta^2 = .001$ (small effect). The quadratic trend (Figure 7) indicates that the growth from the middle of the year to the end of the year is slower than that from the beginning of the year to the middle of the year for both groups.

Figure 6. Interaction between group (CltBP versus Non-CltBP) and time (Beginning, Middle, and End of the Year) for mathematics measured in DIBELS of Cohort 1 (2nd graders)



Text Reading Comprehension

Chi-square test was used to see if the distribution of the students among the four levels of proficiency was the same between CltBP and non-CltBP alumni. Tables 3-5 present the tabulation of the frequency counts with percentage within each group for each category of

proficiency levels at the beginning of the year, middle of the year, and end of the year, respectively.

Table 3

DIBELS count and within-group percentage for beginning-of-year text reading comprehension

	Groups	Far Below Proficient	Below Proficient	Proficient	Above Proficient	χ2 (df)	p
Cohort 1	Non-CltBP (n = 2779)	1389 (50.0%)	150 (5.4%)	1199 (43.1%)	41 (1.5%)	1.52 (3)	.68
	CltBP (n = 19)	12 (63.2%)	1 (5.3%)	6 (31.6%)	0 (0.0%)		
Cohort 2	Non-CltBP (n = 5630)	2779 (49.4%)	566 (10.1%)	1327 (23.6%)	958 (17.0%)	4.10 (3)	.25
	CltBP (n = 34)	14 (41.2%)	4 (11.8%)	6 (17.6%)	10 (29.4%)		
Cohort 3	Non-CltBP (n = 8129)	3900 (48.0%)	1190 (14.6%)	1703 (20.9%)	1336 (16.4%)	1.73 (3)	.63
	CltBP (n = 50)	20 (40.0%)	10 (20.0%)	11 (22.0%)	9 (18.0%)		

There was no statistically significant difference between the CltBP alumni and non-CltBP alumni on the classification of the achievement level for Text Reading Comprehension at the beginning of the year in the three academic years.

Table 4

DIBELS count and within-group percentage for middle-of-year text reading comprehension

	Groups	Far Below Proficient	Below Proficient	Proficient	Above Proficient	χ2 (df)	p
Cohort 1	Non-CltBP (*n* = 2758)	431 (15.6%)	1825 (66.2%)	261 (9.5%)	241 (8.7%)	7.22 (3)	.07
	CltBP (*n* = 19)	4 (21.1%)	9 (47.4%)	5 (26.3%)	1 (5.3%)		
Cohort 2	Non-CltBP (*n* = 5634)	1648 (29.3%)	2217 (39.4%)	1045 (18.5%)	724 (12.9%)	2.68 (3)	.44
	CltBP (*n* = 34)	9 (26.5%)	10 (29.4%)	9 (26.5%)	6 (17.6%)		
Cohort 3	Non-CltBP (*n* = 8143)	3022 (37.1%)	2607 (32.0%)	1391 (17.1%)	1123 (13.8%)	2.15 (3)	.54
	CltBP (*n* = 52)	15 (28.8%)	18 (34.6%)	12 (23.1%)	7 (13.5%)		

There was no statistically significant difference between the CltBP alumni and non-CltBP alumni on the classification of the achievement level for Text Reading Comprehension in the middle of the year in the three academic years except that a significantly larger proportion of CltBP students were at the "proficient" level in comparison to non-CltBP alumni in Cohort 1.

Table 5

DIBELS count and within-group percentage for end-of-year text reading comprehension

	Groups	Far Below Proficient	Below Proficient	Proficient	Above Proficient	χ2 (df)	p
Cohort 1	Non-CltBP (*n* = 2788)	939 (33.7%)	433 (15.5%)	506 (18.1%)	910 (32.6%)	2.48 (3)	.48
	CltBP (*n* = 19)	5 (26.3%)	2 (10.5%)	6 (31.6%)	6 (31.6%)		
Cohort 2	Non-CltBP (*n* = 5602)	2081 (37.1%)	957 (17.1%)	1190 (21.2%)	1374 (24.5%)	2.22 (3)	.53
	CltBP (*n* = 31)	9 (29.0%)	7 (22.6%)	5 (16.1%)	10 (32.3%)		
Cohort 3	Non-CltBP (*n* = 8074)	3140 (38.9%)	1316 (16.3%)	1656 (20.5%)	1962 (24.3%)	14.45 (3)	.002
	CltBP (*n* = 51)	14 (0.8%)	11 (21.6%)	20 (39.2%)	6 (11.8%)		

There was no statistically significant difference between the CltBP alumni and non-CltBP alumni on the classification of the achievement level for Text Reading Comprehension in the end of the year in the three academic years except that a significantly larger proportion of CltBP students were at the "proficient" level in comparison to non-CltBP alumni in Cohort 3 although a significantly larger proportion of non-CltBP alumni were at the "above proficient" level in comparison to CltBP-alumni in the same academic year.

MAP

Descriptive statistics as well as independent sample t-tests results for the comparison on MAP are presented in Table 6. CltBP alumni not only outperformed non-CltBP alumni on the Winter to Winter Conditional Growth Percent but also on the Spring to Spring Conditional Growth Percent with medium effect size. These two indicators represent annual growth in academics (reading) based upon the projected and the observed growth. The effect size was measured with Cohen's *d* where 0.20 was considered a small effect and 0.80 was considered a large effect size. Values between 0.20 and 0.80 were considered medium effect sizes (Cohen, 1988).

Table 6

MAP test comparisons

	Groups	*M* (SD)	t	P	d
Winter to Winter Conditional Growth Percent in Reading	CltBP (*n*=41)	79.51 (26.44)	2.80	.005	0.48
	Non-CltBP (*n*=5538)	65.42 (32.18)			
Spring to Spring Conditional Growth Percent in Reading	CltBP (*n*=41)	73.70 (25.26)	2.15	.03	0.36
	Non-CltBP (*n*=5670)	63.54 (31.31)			

Grades

Descriptive statistics and results from MANOVA are presented in Table 7 for the comparison between CltBP and Non-CltBP students in their performance in Kindergarten on reading and mathematics assessments. While the researchers requested K-2 MAP data from CMS, the district only provided Kindergarten data.

Table 7

Kindergarten reading and mathematics grades comparison (Cohort 3)

	Groups	*M* (SD)	F	P	η^2
Reading	CltBP (*n*=30)	2.71 (0.41)	7.09	.008	.002
	Non-CltBP (*n*=4575)	2.45 (0.53)			
Mathematics	CltBP (*n*=30)	2.80 (0.35)	4.79	.029	.001
	Non-CltBP (*n*=4575)	2.60 (0.48)			

MANOVA results show that CltBP and Non-CltBP students differ significantly in the assessment of their reading and mathematics competence in Kindergarten, Wilk's $\lambda = 0.55$, $F(2, 4572) = 3.58$, $p = .028$, partial $\eta^2 = .002$. Tests of between-subjects effects suggest that CltBP students outperform non-CltBP students in reading, $F(1, 4573) = 7.09$, $p = .008$, partial $\eta^2 = .002$; and mathematics, $F(1, 4573) = 4379$, $p = .029$, partial $\eta^2 = .001$, respectively. Although the effect size is small, CltBP students' reading and mathematics competence assessed by their

classroom teachers at Kindergarten were both statistically higher than that of Non-CltBP students.

Discussion

Comparative Performance with Non-CltBP Hispanic Students

Preliminary data using the DIBELS measure indicate CltBP alumni are entering kindergarten scoring above their Hispanic counterparts by approximately four points in reading (162.03 vs. 158.04) and two points in math (160.23 vs. 158.21). This advantage remains consistent at both the middle and end of year administrations, with a slight increase in reading (five-point difference) by the end of the year (see Table 2, Figure 2, Figure 3). Additionally, data show CltBP students enter first grade scoring ahead of their Hispanic peers in both reading (148.95 vs. 146.34) and math (147.59 vs. 144.16), and the advantage is slightly increased for CltBP alumni by the end of year administration with the difference widening by one additional point in reading and two points in math (see Table 2, Figure 4, Figure 5). As students entered second grade, CltBP alumni began the year marginally above their Hispanic peers in reading (139.95 vs. 139.12), however they continued to outscore their peers in math (137.70 vs. 135.25) and the difference widened by the end of year test administration (156.85 vs. 152.39) (see Table 2, Figure 6, Figure 7).

These data are substantiated with MAP test comparisons. MAP tests are administered in the fall, winter, and spring each year to measure reading skills and are compared over a period of time, either winter to winter or spring to spring. These measures are "conditional" because they take into account student performance at the beginning of the year as a benchmark. In comparing CltBP alumni (41) with Hispanic students in CMS (5538), data show significant statistical difference between both their winter to winter and spring to spring growth, with the CltBP alumni making greater growth gains in reading than their Hispanic peers (see Table 6).

In order to consider a fuller picture of alumni performance beyond standardized testing, kindergarten grades were also collected and analyzed. Because these data are collected over an entire year with multiple means of measurement, assessment, and presentation, and because they are regularly assessed by teachers, they are considered more reliable data than MAP test scores alone. Students are graded four times a year to evaluate

subsets of reading and mathematics skills. Consistent with the standardized testing results, data show significant statistical difference between CltBP kindergarten alumni and their Hispanic peers in the assessment of their reading and mathematics skill performance (see Table 7), with CltBP alumni demonstrating higher levels of skill-related competence as assessed by their teachers than their peers in both areas (standard deviation of 2.71 vs. 2.45 in reading and 2.80 vs. 2.60 in mathematics). The reading result is particularly significant when we consider that CltBP alumni are bilingual learners, and research literature has historically indicated bilingual learners can appear to be delayed in showing single language competency on par with peers (see Fennel et al, 2002; Genesee, 2001; Johnson & Wilson, 2002). These data call into question this long-held belief.

Performing Ahead of Peers

With regard to our research questions, we believe, based on these data, we can state:

1. CltBP students are not only at the same readiness level as their Hispanic peers, they actually enter ahead in both mathematics and reading.
2. These accelerated readiness levels endure, to varying degrees, through first and second grade.

These data findings—that CltBP alumni are outperforming their Hispanic peers in kindergarten and maintaining this advantage through first and second grade—seem to point to the CltBP's effectiveness in delivering a quality program focused on kindergarten-readiness. This becomes particularly poignant when we consider the demographic make-up of each population. While both populations are identified in CMS as Hispanic, the CltBP alumni are entirely from Spanish-dominant homes with low socio-economic status. The CMS population whose families are identified as Hispanic represents children from diverse linguistic and socio-economic backgrounds, which includes backgrounds similar to those from CltBP, but also includes higher and lower socio-economic levels as well as English-dominant, bilingual, and multilingual households. Additionally, some of the students identified ethnically as Hispanic by CMS come from families composed of several generations of American-born people as well as multiethnic family configurations. CltBP alumni, on the other hand, are more often first- or second-generation immigrants from Spanish-speaking Latin American countries.

Historically, CltBP alumni represent a group at higher risk for low academic achievement. However, our data indicate CltBP students are entering kindergarten ahead of their peers, demonstrating higher skill attainment and competency, and maintaining consistent growth and advantage for three years after their leaving the preschool. Considering that research has consistently demonstrated correlations between non-English speaking households, low socio-economic households, and lower academic achievement in schools (e.g., Hoff, 2013), these data support the assertion that the CLTBP program effectively prepares students to be kindergarten- and school-ready.

It is important to point out we do not know the number of students in the CMS Hispanic population who had access to or had been enrolled in any form of preschool experiences. Additionally, we do not have comparative data for non-Hispanic student populations. These data would have required extensive permissions we were not able to secure. We will, however, continue to investigate what phenomena may be correlated with these results through the qualitative prong of this research study.

Still Demonstrating an Achievement Gap

While data indicate that CltBP alumni enter kindergarten demonstrating higher reading and math achievement than some peers, there are still many students who are not meeting proficiency levels. DIBELS data show there continues to be a need to help more students achieve at higher levels of performance. For example, 60% of CltBP alumni enrolled in CMS kindergarten scored below proficient or far below proficient in reading comprehension at the beginning of the school year (63% at the middle of the year DIBELS administration), compared to 62% of non-CltBP kindergarten students (69% at the middle of the year). These data appear to substantiate issues of racial, economic, and linguistically correlated achievement gaps (see Table 3, Table 4, Table 5). Hispanics are the fastest growing student population in the United States, yet closing the achievement gap between Spanish-speaking students and European American students remains a challenge (e.g., Hemphill & Vanneman, 2011). The students in this study are all K-2 students so they have not taken End-of-Grade (EOG) tests (which start to be administered in 3rd grade in CMS); however, studies have shown the DIBELS scores are highly correlated with EOG scores in later grades (e.g., Salvador et al., 2009).

Although CltBP alumni perform above their Spanish-speaking peers, across all demographics within CMS these students are still performing below average. The population of the school system includes affluent students as well as those in high poverty, monolingual speakers, as well as proficient multilinguals from various parts of the world, students at all levels of aptitude for learning, and so forth. Therefore, we can argue that the bilingual instruction provided at CltBP can narrow the achievement gap but has not completely closed it because, in general terms, the culturally and linguistically diverse, low-SES population served by CltBP is still historically underrepresented. The data do show that CltBP is a viable program to address the Leading on Opportunity Task Force's recommendation for early, high-quality childcare and education for Spanish-speaking (Latino) children.

Limitations

We have identified a number of limitations in the comparative data. First, as mentioned above, CMS provided a dataset of all K-2 students self-identified as Hispanic. That term is used to describe all Hispanic students in CMS regardless of SES, country of origin, cultural background, linguistic dominance, level of proficiency in the Spanish language, place of birth, years in the US public school systems, preschool experience, learning abilities, or any other descriptive or demographic factors. Second, the scores refer to standardized summative assessments. DIBELS is static and MAPS is adaptive, but neither takes into consideration diverse funds of knowledge or individualized, more comprehensible evaluations. The grades data were collected in the attempt to assuage this limitation, but we only had access to the results found in kindergarten in Cohort 3 and not for the entirety of CltBP alumni participants.

We recognize these data only compare CltBP alumni with their Hispanic peers and not with children in other racial categories. While we realize this would be exceptionally important to consider, obtaining disaggregated data for thousands of students within this large urban school district provides a significant challenge to our ability to make such comparisons and is beyond the scope of this paper.

We were also limited in the data we could collect. While most of CltBP's alumni enter a CMS public school kindergarten, there are some who enroll in private, church-based, or charter kindergartens. Non-public school kindergartens in the Charlotte-Mecklenburg area

do not collect MAP and DIBELS data and the criteria for classroom grading differs. We, therefore, were not able to include these students, many of whom are high-achieving, in the dataset. We seek to capture these data through the qualitative prong of the larger study.

Conclusion

This study serves as a support for bilingual preschool education as it shows the positive impact of the CltBP program for kindergarten- and school-readiness. It also raises the discussion about standardized testing regarding what is privileged and what is omitted. The quantitative analysis calls for a supplementary qualitative analysis of these findings to explain which factors make CltBP a successful program so that it can be reproduced in other institutions. During the discussion of data, we as researchers and educators continued to wonder: 1) to what degree does bilingual education make a difference? and 2) how much of the positive impact resulted from students attending a high-quality program regardless of the language of instruction?

CltBP is growing a viable bilingual program that warrants replication. Its Board and Executive Director seek to be not only a model for bilingual early childhood education, but also a leader and catalyst in developing similar programs across the Charlotte-Mecklenburg region. Its existence and instructional architecture are, in and of themselves, not something to take lightly. It is a program learning to improve and effectively continuing toward its ultimate goal of eliminating learning gaps between Spanish-speaking students and students from other demographic populations.

For future research, we recommend the comparison of CltBP alumni to all groups of students enrolled in CMS as opposed to comparing them just to the population identified as Hispanic. We also recommend inclusion of data up to 3rd grade, which comprises standardized end-of-year examinations. Additionally, we consider it relevant to capture the data from non-public school destinations, keeping in mind assessment data from charter and private schools may not be comparable to that collected from public schools. That broader scope of CltBP alumni's school readiness and academic performance can paint a more accurate picture of the impact of the bilingual program toward the goals established by the Leading on Opportunity Task Force. Quantitative as well as qualitative research can show

ways in which this school's high-quality bilingual education can help assuage issues of upward mobility within this large, urban district.

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