The Challenges and Opportunities of Implementing Montessori Education in the Public Sector

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Abstract: Over the past two decades, Montessori education in the United States has rapidly expanded from the private to the public sector. This expansion has created important questions about whether or not the Montessori approach can thrive alongside the education standards and accountability movement in the public sector. Questions also exist as to precisely who is benefitting from this expansion of and investment in public Montessori. To examine these topics, this study focused on South Carolina, the state with the highest number of public programs in the United States. We used implementation surveys, classroom observations, and teacher interview data collected by the research team and student record data collected by the state of South Carolina to conduct the analysis, which consisted of three parts. First, we investigated to what extent public programs in South Carolina are able to implement Montessori education with fidelity to the model. Second, we considered what program characteristics were related to higher levels of Montessori implementation fidelity. Third, we analyzed which children had access to higher-fidelity Montessori programs. Generally, findings indicated that, despite challenges created by the education standards and accountability movement and concerns expressed by educators about authenticity, most programs in South Carolina were implementing Montessori with fidelity. Several characteristics were associated with higher levels of fidelity, including the age of the program. Findings also indicated that Black, Hispanic, and students from low-income families were disproportionately participating in lower fidelity programs. Our study provides an in-depth analysis of the challenges and opportunities associated with government trying to implement successful private-sector education models in the public sector.

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Introduction

In the over 100 years since Dr. Maria Montessori developed her child-centered educational approach, Montessori education has rapidly spread across the world. As the access to Montessori has grown, it becomes more difficult to ensure adherence or fidelity to the central tenets of the Montessori model. This challenge is exacerbated by the standards and accountability educational reform movement, as it is referred to in the United States, which offers an approach to education that often conflicts with tenets of Montessori. The Montessori model emphasizes student-guided work rather than the rigid standards emphasized by this top-down approach. Further, evaluation by standardized tests is largely antithetical to the Montessori method, which emphasizes intrinsic motivation and learning at a student's own pace. The key tenets of the Montessori approach are graphically presented by Culclasure et al. (2019) in the form of a logic model with key program inputs, outputs, and outcomes discussed.

The tension between fidelity to the Montessori model and the education accountability movement is quite visible in public Montessori implementation in the United States. From the creation of its first school in the United States in 1911, Montessori education has earned much acclaim within the private school community for its overall approach to teaching and student learning. Its entrance into public education has been slower, but over the last several decades, Montessori has begun to gain a foothold in America's public schools (Whitescarver & Cossentino, 2008).

As the prevalence of Montessori education continues to expand in the United States public sector, questions have emerged regarding how well the Montessori approach fits with standards and accountability reforms. Little currently is known about how Montessori is being implemented in public schools and the possible effects of Montessori education on public school students.[1] Can higher fidelity Montessori education be implemented in the public sector? If so, who has access to these programs? To examine these topics, we developed a study of public Montessori implementation in the state of South Carolina. The study consists of three parts. First, we used multiple methods to investigate the extent to which public Montessori programs were implementing the Montessori model with fidelity. Second, we considered which factors were associated with higher levels of Montessori program fidelity in South Carolina. Last, researchers considered which student populations had access to higher fidelity Montessori programs and which did not.

The Montessori Model and Education Reform

Many aspects of Montessori education are quite different than the status quo in most traditional American public schools today. Montessori education provides a "child-centered" approach to schooling, as opposed to the arguably "one-size fits all" approach of some public schools. Further, some aspects of Montessori education seem to conflict with current standards and accountability movement. While the Montessori curriculum outlines what students should learn, the pacing is individualized to fit the interests and abilities of the student (Montessori, 1964). The role of the teacher is also different in Montessori schools. Rather than teaching from the front of the room, Montessori teachers interact with students in small groups or on a one-to-one basis as students work independently (Block, 2015; Montessori, 1964). Teachers are well-trained to be facilitators and humble observers, preparing a carefully crafted learning environment (Montessori, 2020). The organization of the classroom is unique. Typically, in public Montessori schools in the United States, students aged 3–6 (primary level), 6–9 (lower elementary), and 9–12 (upper elementary) are in the same classroom for a three-year span with the older students often mentoring or assisting the younger students (Lillard, 2012; Montessori, 1964). Rather than traditional scripts, textbooks, and worksheets, the Montessori method relies on the usage of Montessori learning materials that encourage hands-on learning. The environment in a Montessori classroom is orderly, pleasant, clean, and safe for children.

Not surprisingly, assessment in a classroom implementing high fidelity Montessori education is much different than it is in a traditional public school classroom. Montessori teachers make observations of students as the students work; teachers take consistent and comprehensive notes on how students are performing (Block, 2015; Montessori, 1964). Based on these observations, students and teachers create individualized work plans and learning goals. Fundamentally, the Montessori approach prioritizes intrinsic motivation and the development of the whole child, including creativity, respect for self and others, cognitive and socio-emotional abilities, and a sense of community (Block, 2015; Lillard, 2012; Montessori, 1964).

As public school choice options, such as magnet schools and charter schools,[2] have increased in the U.S., education reformers have increasingly looked at the Montessori model as a way to provide an innovative approach to education in the public sector. As of 2016, there are approximately 150,000–200,000 public Montessori students attending over 550 public Montessori schools across the United States (Sparks, 2016). According to a survey of charter schools by the Center for Education Reform (2014), Montessori was the seventh most popular academic theme for charter schools behind College Prep, Core Knowledge, STEM, Blended Learning, Constructivist, and Back to Basics. Montessori was more popular than other themes such as Fine Arts, Virtual/Online, Bilingual/Foreign Language, and Vocational Education. Analyses of parental decision-making when it comes to school options for their children often find that the quality of curriculum and instruction and a particular approach to education, like Montessori, are important school characteristics that parents consider (Bosetti & Pyryt, 2007; Bukhari & Randall, 2009).

Public Montessori programs are commonly understood to be a good fit for charter school and other public school choice models. On the one hand, public Montessori stands in stark contrast to the traditional public school model. On the other hand, Montessori in the public sector may not be seen as a "risk" for charter school authorizers due in part to its long, strong track record in the private sector and in the public sector since 1967, which marked the opening of the first public Montessori school in Reading, Ohio (AMS, 2022). Therefore, Montessori education seems to provide an innovative, yet not overly "risky" alternative for public education reformers, which is likely why it has increased in popularity over the last several decades.

In contrast to its natural suitability with the public school choice movement, the Montessori model's fit within the standards and accountability movement is less certain. The focus on common standards, high-stakes testing, and increased accountability for teachers and schools are part of what Sahlberg (2016) calls the "Global Education Reform Movement" (GERM). Since it's conception in the United States and England in the late 1980s, GERM has spread to many countries throughout the world, from Central and Eastern Europe, to South America, the Middle East, South Africa, and East Asia. International organizations have often fostered GERM. The World Bank has promoted increased education accountability and standards since the 1990s, and a 2017 UNESCO report argued that without improved accountability global educational goals will not be met. Högberg and Lindgren (2021) find that the term "accountability" is mentioned more than 500 times in the 2016 OECD publication, *Governing Education in a Complex World*. These calls for increased accountability have led to policy change in many countries. PISA data indicate that school accountability policies have become more prevalent in participating countries from 2000 to 2015 (Högberg & Lindgren, 2021), and Verger et al. (2019) find that the delivery of standardized curricula is increasingly being monitored by national education systems through the use of large-scale standardized testing.

Various studies have examined the possible negative consequences of this movement (e.g., Nichols & Berliner, 2007; Ravitch, 2011). State-mandated testing regimes can lead to teachers narrowing the curriculum, to spending large amounts of time on test-taking strategies, and, ultimately, to teacher burnout (Abrams et al., 2003; Berryhill et al., 2009).

These general concerns regarding standards and accountability are heightened in public Montessori programs, as the standards and testing approach are largely antithetical to the Montessori model. This is a growing concern, as a review of 101 education systems by UNESCO (2017) found that 95% had some type of national testing. Shortly after the federal No Child Left Behind Act was passed in 2001 in the United States, which mandated state standards and annual standard testing, the American Montessori Society (AMS) (2002) issued a press release that quoted the AMS national director, Michael Eanes: "Mandated proficiency testing represents a diametric departure from the Montessori educational model because it fragments the educational experience, separates schooling from life and limits opportunity for autonomous learning and choice."

Montessori educators and researchers believe that narrow standardized tests are neither an adequate nor an appropriate measure of student learning. In one study, Rathunde and Csikszentmihalyi (2005) compare the attitudes of students in primarily private Montessori schools that did not have a standards and accountability approach to other students attending traditional public middle schools. They found that Montessori students felt higher levels of affect, undivided interest, and intrinsic motivation when engaged in academic work at school than traditional public school students. Montessori students found approximately 40 percent of their schoolwork intrinsically motivating and important, compared to traditional public school students who felt

the same way only 24% of the time. According to one proponent of Montessori education, "When the stakes for children are high (as when the tests determine whether they can proceed to the next grade or graduate), the tests produce feelings of fear and dread. To those of us who want children to love learning, test-driven education is a disaster" (Crain, 2003, p. 10). Research from the United States indicates that private Montessori schools are 39% less likely to participate in a school voucher programs than traditional private schools are (DeAngelis, 2020), possibly because Montessori school leaders are wary of increased governmental regulation and standardization, including state testing requirements, which could conflict with the Montessori model (DeAngelis et al., 2021). In addition to the philosophical tensions between Montessori education and the accountability movement, there are also more practical challenges. The multi-age classrooms and individual pacing of learning make it difficult to match Montessori to specific grade-level standards (Jacobson, 2007; Murray & Peyton, 2008). Further, the Montessori model includes long uninterrupted blocks of work time; therefore, its students are not used to and thus at a disadvantage for the timed assessments associated with standardized tests (Lillard, 2016).

Implementing the Montessori Model in Public Schools

Implementation fidelity is an important component in evaluating the success of public policies and programs. Simply put, implementation fidelity can be defined as "how well a program is implemented relative to the original or the ideal" (Lillard, 2012, p. 380). Fixsen et al. (2013) note that improved student outcomes from effective interventions can only be realized through effective implementation, but the majority of education evaluation research focuses on narrow program evaluations while largely overlooking how to successfully implement and scale up successful programs. By ignoring implementation fidelity, evaluators run the risk of committing Type III error, which is concluding that a program was ineffective when in actuality it was not implemented with fidelity (Dusenbury et al., 2003). Scaling up interventions in a way that maintains high levels of fidelity can be very difficult and can create a host of challenges (Glennan et al., 2004).

These implementation challenges are even more significant in the public Montessori context. Given the inherent tensions between the Montessori model and the standards and accountability movement, it is an open question as to whether public school students participating in Montessori programs receive a "true" Montessori education. There is some reason to believe that public Montessori teachers are able to implement the model with a high level of fidelity. According to one survey of Montessori principals, only 13% strongly agreed that standardized testing in the school "compromises the character of the Montessori program" (Murray & Peyton, 2008). Teachers, as street-level bureaucrats (Lipsky, 1980), generally have the discretion to act in a way to fit the needs of students and the teachers' professional beliefs. Goldstein (2008) notes how teachers interpret district, state, or federal policies through their professional lenses as teachers. Teachers do not simply parrot state standards and proctor standardized exams. Another reason to believe that a higher fidelity Montessori model can still thrive in the public sector is that a large percentage of public Montessori education is at the pre-kindergarten (PK) to early elementary level. Since most state-mandated testing regimes in the U.S. start in third grade, perhaps many Montessori programs are spared the accountability testing pressure.

However, there is considerable evidence that implementing higher fidelity Montessori education in the public sector is difficult because of federal, state, and district mandates, including standards and accountability tests. Public Montessori schools realize that they must show strong results on the state tests or risk losing support. According to one public Montessori principal, "We see more stress on the teachers. It's really against their philosophy to test their children. But if we don't show that this program helps children perform, then [school system officials] will do away with our program" (Jacobson, 2007). While it is true that only upper elementary, middle, and high school students face high-stakes standardized testing in the United States, the standards and accountability mindset also permeates the younger grades, even in Montessori schools (e.g., Gonzalez, 2014; Jacobson, 2007). Perhaps, these tensions are too strong, as only 28% of public Montessori principals strongly agreed that they implement the Montessori program "according to the original version of Maria Montessori" (Murray & Peyton, 2008). This may indicate that Montessori schools are changing curricula to meet the demands of districts and states in an effort to ensure the longevity of their.

Education researchers have lagged behind those in other policy areas in terms of recognizing the importance

of studying fidelity of implementation (O'Donnell, 2008), and this shortcoming has permeated Montessori research as well. Evaluations of Montessori programs have generally assumed high levels of fidelity without directly examining it. This may be one reason for the inconsistent results of Montessori evaluations (Lillard, 2012). However, a growing number of Montessori researchers are examining this question (e.g., Block, 2015; Daoust & Suzuki, 2014; Lillard, 2012; Scott & Glaze, 2017). Daoust and Suzuski (2014) find great variation in implementation fidelity to the Montessori model in public Montessori schools. Block's (2015) case study of a public Montessori school in the U.S. found that Montessori school officials change classroom practices, assessments, and curriculum in a way that diminishes fidelity to the Montessori model in order to meet governmental mandates. Teachers developed work plans for students based on individual grade levels within the mixed-age classrooms and changed assessment procedures to prepare students for state standardized tests. "Second- and third-grade students were explicitly taught test-taking skills for one hour each day for six weeks in an attempt to raise the school's assessment scores" (Block, 2015, p. 48). This means that the child-centered classroom shifted to a more teacher-directed learning environment with more rigid timetables.

An examination of the fidelity to the Montessori model in the public sector is more than just a "truth in advertising" exercise.[3] It can have important implications for student outcomes. Lillard (2012) compares the academic performance of three sets of students: those attending private, high fidelity Montessori programs; students in private, low fidelity Montessori programs that supplemented the program with conventional schoolwork; and a conventional comparison group attending nearby private schools. Those students in the high fidelity Montessori programs exhibited more positive student outcomes than both of the other groups. This finding is consistent with the literature that finds high fidelity implementation is a key component for effective programs (O'Donnell, 2008). Given that Lillard's (2012) analysis focused on private Montessori schools, further questions need to be asked about public Montessori programs.

It also is important to consider who has access to higher fidelity Montessori programs. In the private sector, Montessori education is often seen as an elite, largely-white education option. However, Maria Montessori started her career by educating poor children in the slums of Italy. The history of public Montessori in the United States demonstrates that the Montessori approach to education has been attractive to a diversity of parents (Debs, 2019).

Previous research indicates that high fidelity Montessori pedagogy can significantly increase student learning (Lillard, 2012). However, not all public school students have equal access to higher fidelity Montessori (Debs, 2019). When public Montessori students are compared to other students in the surrounding area, there is evidence that white students are overrepresented in public Montessori programs (Brown, 2016; Culclasure et al., 2018; Debs, 2016). Debs and Brown (2017) also note several cases in which Montessori charter applications or renewals have been denied or given increased scrutiny because of concerns that these programs may increase racial isolation in public schools.

These considerations and others highlight the need to explore not only which types of students are being served by public Montessori, but also whether or not certain groups are concentrated in higher fidelity schools. Are higher fidelity public Montessori schools over populated by high-income students? Do mostly white students attend these schools, leaving children of color learning in schools classified as lower fidelity? These important questions are addressed in this study.

Study Design and Research Questions

The Montessori model seems like a promising way to provide a unique approach to education in the public sector and studies have shown that exposure to higher fidelity Montessori programs has increased student achievement more than conventional private schooling (Lillard, 2012). However, given federal, state, and district mandates, it may be difficult to implement high fidelity Montessori programs in public schools. As outlined above, there are important questions as to whether higher fidelity Montessori education can be implemented in public schools given the global standards and assessment movement. In addition, there are questions about who and which types of families are served by these schools.

To examine these questions, we developed a study of public Montessori education that focused on the state of South Carolina. Whereas other evaluations of public Montessori education have examined a small number of Montessori schools (Lillard et al., 2017; Lillard & Else-Quest, 2006), this study focuses on all of South Carolina's 45 public Montessori programs. As of 2022 and has been the case for years, this represents the largest number of public Montessori programs in the United States

(NCMPS, 2022). Montessori programs in South Carolina are found in all levels of schools and are classified in the following way: students ages 3–6 (primary level); ages 6–9 (lower elementary); ages 9–12 (upper elementary); and secondary programs for ages 12+. This study focused only on the primary, lower elementary, and upper elementary levels.

Listed below are the three research questions this study explored:

Research Question 1: To what extent is the Montessori model being implemented with fidelity in South Carolina's public Montessori schools?
Research Question 2: what program characteristics are associated with higher levels of fidelity to the Montessori model in public Montessori schools in South Carolina?
Research Question 3: what types of students have access to higher fidelity public Montessori schools in South Carolina?

Methodology and Instruments

Measuring Fidelity to the Model

Measuring fidelity to the Montessori model was key in addressing all three research questions. At the time of this study, no validated instrument existed that could be used to measure program fidelity in Montessori schools. We thus created a new instrument to measure fidelity for use in this study. In our case, it was crucial as researchers that we were able to observe directly the classroom environment to see what teachers were doing in the classroom and how students were learning. We understood that a true measure of fidelity required having specifically trained observers using valid tools to closely examine the teaching and learning taking place in enough classrooms to be able to draw conclusions.

After much consideration, we decided upon two methods to measure fidelity to the model that allowed us to classify schools into one of three fidelity levels. First, we administered an in-depth implementation survey to the principals of all Montessori programs across the state. Second, we measured fidelity via observations of Montessori classrooms using researcher-created instruments. These observations included a short post-observation interview with the teachers observed to obtain more detailed information about classroom practices and methods. We collected four years of observation data (2012–13, 2013–14, 2014–15, 2015–16) and observed at every program in South Carolina. Excluding pilot data, a total of 99 classrooms were included in the study.

Regarding the implementation surveys, Montessori principals completed the survey about their school's Montessori program each year. Surveys were developed by the research team and underwent an extensive review by the project's Montessori expert consultant, as well as leaders from numerous national and statewide Montessori organizations including the American Montessori Society (AMS) and the National Center for Montessori in the Public Sector (NCMPS). The implementation survey focused on four critical implementation factors: multi-aged groupings, teacher training, uninterrupted work period, and Montessori materials.[4] During the course of the study, we collected four years of survey data (2012–13, 2013–14, 2014–15, 2015–16) via a web-based administration process. We received at least one survey from each of the different public Montessori programs across the state during the four years of the study.[5] See Appendix A for a copy of the principal survey instrument.

Schools not meeting a minimum threshold for fidelity on the programmatic implementation survey were not included in further classroom observations, as we determined that they could not even be considered a low fidelity school without basic tenets of Montessori implementation. Programs that met the minimum threshold for fidelity on the programmatic implementation survey were promoted to the classroom observation and teacher interview process.

Classroom observations and teacher interviews took place in randomly selected classrooms and during the uninterrupted work time. The observation process consisted of an unannounced hour-long classroom observation followed by an informal interview with the teacher. The purpose of the observation was to assess each classroom's prepared environment, classroom climate, student learning, and teacher instruction. The purpose of the post-observation teacher interview was for the observer to examine how the teacher conducted lesson planning, record keeping, and assessment of student progress.

Classroom observations/interviews were conducted by retired Montessori teachers and teacher trainers who met stringent credential requirements and had prior experience in a Montessori public school setting. All observers had a Montessori credential for the level they observed. Observers also underwent extensive training conducted by the project Montessori expert consultant

and the principal investigator prior to conducting observations.

The instruments used by observers were developed by the study team and the Montessori project expert consultant. The main resources used to develop this instrument include Lillard's (2016) Eight Principles of Montessori Education, the Classroom Assessment Scoring System, an observation instrument to assess classroom quality in pre-school (Pianta, 2003), and Montessori Classroom Observation Checklists from several national Montessori organizations. The instruments then were reviewed by leaders in a variety of national and statewide Montessori professional organizations including the American Montessori Society (AMS) and the National Center for Montessori in the Public Sector (NCMPS). The instrument was piloted across classrooms in South Carolina. An inter-rater reliability study was conducted to establish and confirm the reliability of the data collection instruments.

There was a separate observation instrument for the three levels of classes that were observed, each with its own unique set of indicators that are widely accepted as being necessary for Montessori classrooms of high quality (i.e., adhering to the principles and method of Montessori education). Please see Appendix B for a copy of the observation instrument and the post-observation teacher questionnaire.

Scoring

In order to simplify the scoring of the surveys, we selected three critical questions focusing on Montessori materials, multi-aged grouping, and uninterrupted work periods, and based the implementation survey score on answers to these questions. For example, we asked about the existence of multi-aged classrooms, an important component of Montessori. If the principal reported that all the classrooms were properly multi-aged, the answer received a ten. If 76% to 99% were properly multi-aged, the answer received an eight; 51% to 75% received a six; 26% to 50% received a four; 1% to 25% received a two; and if none of the classrooms were properly multi-aged, the answer received a zero. This scoring technique was used for the remaining questions. Given that principals received the implementation survey each year, we created average scores across all four years for which data were available (since schools may have submitted a survey for all years of the study, or they may only have submitted a survey for one, two, or three years).

To score the classroom observations/interviews, observers used rubrics to quantify their observations. It is important to emphasize that these are criterion-referenced measures, meaning that each observation or interview is compared to the rubric to produce a value. The indicators for all three levels were divided into the same areas: Prepared Environment, Classroom Climate, Student Learning, Teacher Instruction, and Assistant Instruction. There were between 10 and 15 indicators for each of the five areas. The rating scale for each indicator was Met, Somewhat Met, or Not Met. All indicators were treated alike and assigned points as follows: Met = 2; Somewhat Met = 1; and Not Met = 0. Points were tallied and divided by the maximum number of points that could be earned to derive a percentage score. Scoring for the post-observation interview focused on Lesson Planning; Recordkeeping; and Student Assessment. Interview responses also were scored as Met (2), Somewhat Met (1), or Not Met (0) based on information recorded by the researcher on a matrix. The results of the entire observation were scored in a way that provided a percentage score for the observation and a percentage score for the post-observation interview. Once percentages were calculated for these two pieces, they were averaged, and a total percentage score was determined for each classroom.

Working with our Montessori consultant, who had vast experience with South Carolina's Montessori programs, we used our observation data, teacher interview results, and the implementation survey data to create a classification scheme of Montessori fidelity by program. This would allow us to make comparisons between programs with different levels of fidelity. We labeled programs as falling into a high, medium, or low fidelity category. Importantly, these are not relative fidelity rankings; rather, programs were compared to the components that were identified as necessary for higher fidelity Montessori implementation.

Sampling Procedures

Given that there were approximately 315 Montessori classrooms in public South Carolina schools at the start of the four-year study, we knew it would be impossible to measure fidelity in all classrooms each year. Therefore, we employed a stratified random sampling technique where we observed at least one classroom at every school across the state during the course of the study, and based the number of classrooms observed on the size of the school (i.e., the more classrooms a program had, the higher number of classrooms observed at that school[6]).

We also took into consideration the levels of Montessori provided at each school (primary, lower elementary, and upper elementary) and sampled classrooms to ensure a proportional representation of levels of Montessori. Our goal was to observe a consistent percentage of classrooms across all levels of Montessori and in all programs. Including our pilot observations, we visited 126 classrooms across the state. Our analytical sample included 99 classroom observations from 45 Montessori programs. Seventeen programs had one classroom visit, 17 programs had two classroom observations, and the remaining 11 programs had between three and eight visits. Since principals of all Montessori programs across the state were administered the implementation survey each year of the study, no sampling procedures were necessary with the implementation surveying process.

Data Analysis Procedures

In this study, we incorporate the data from classroom observations, teacher interviews, and principal surveys described above with the South Carolina student record database, PowerSchool.[7] The student record data include all public school students in South Carolina in 2015–16. Importantly, this database has an indicator variable for students who are enrolled in a Montessori program. To ensure the validity of the Montessori variable, the research team worked with Montessori schools to ensure the correct coding of the variable. This was particularly important, as many South Carolina public Montessori schools have a program-within-a-school structure, which means that a school may provide both Montessori and traditional classes. For the purposes of this study, we treat Montessori programs that operate as a program-within-a-school, as if they were separate schools. For example, when we discuss the demographics of Montessori students in a program-within-a-school, we only use data for those students who received Montessori education, not all students enrolled in the school.

While the classroom observation and teacher interview data provide information at the classroom level, the principal surveys only provide school or program-level data. The student database does not provide a way to aggregate students to the classroom-level. The analyses to examine the fidelity of Montessori implementation (Research Question 1) are at the classroom-level, while the analyses to examine the factors associated with high fidelity (Research Question 2) are at the program/school-level, and the analysis of student access to high fidelity Montessori (Research Question 3) is at the student- and school-level. Classroom observation and teacher survey data were averaged across classrooms, teachers, and years to create school-level measures for these factors.

This study provides a descriptive investigation of public Montessori in South Carolina. The quantitative analyses performed in this study are meant to illustrate the state of Montessori education, rather than to test specific statistical hypotheses. In addition to providing univariate results, we provide bivariate comparisons to examine differences by fidelity level. All analyses were conducted using the Stata software program.

Results & Analysis

Research Question 1: To what extent is the Montessori model being implemented with fidelity in South Carolina's public Montessori schools?

We first described the results of our classroom observations and teacher interviews. Excluding our pilot data, our research team examined 99 Montessori classrooms throughout public schools in South Carolina. Using the rubric described above, trained Montessorians examined each classroom on a number of dimensions. Figure 1 presents histograms of the classroom observation scores by area. For each of the five areas, classrooms received a score between 0% to 100%.

One sees that classrooms generally received high marks. This was particularly true in terms of classroom climate with the average score being 93%. Observers generally found that classrooms also had high levels in terms of student learning (mean of 87%), teacher instruction (mean of 85%), and assistant instruction (mean of 86%). Observation scores were the lowest for prepared environment with an average score of 74%. A focus on the average score, however, overlooks the variation in classrooms on these dimensions. Eighty-eight percent of classrooms scored at least 80% on classroom environment, demonstrating that there was broad success in this area. Less than 10 percent of classrooms scored below a 60% for student learning, teacher instruction, and assistant instruction, again showing that most classrooms were at least adequate on these measures. The prepared environment shows more variability. While about 45% of classrooms scored at least 80% on this measure, 20% of classrooms scored at or below 59%, demonstrating that a significant proportion of classrooms lacked the necessary Montessori materials. This may be evidence

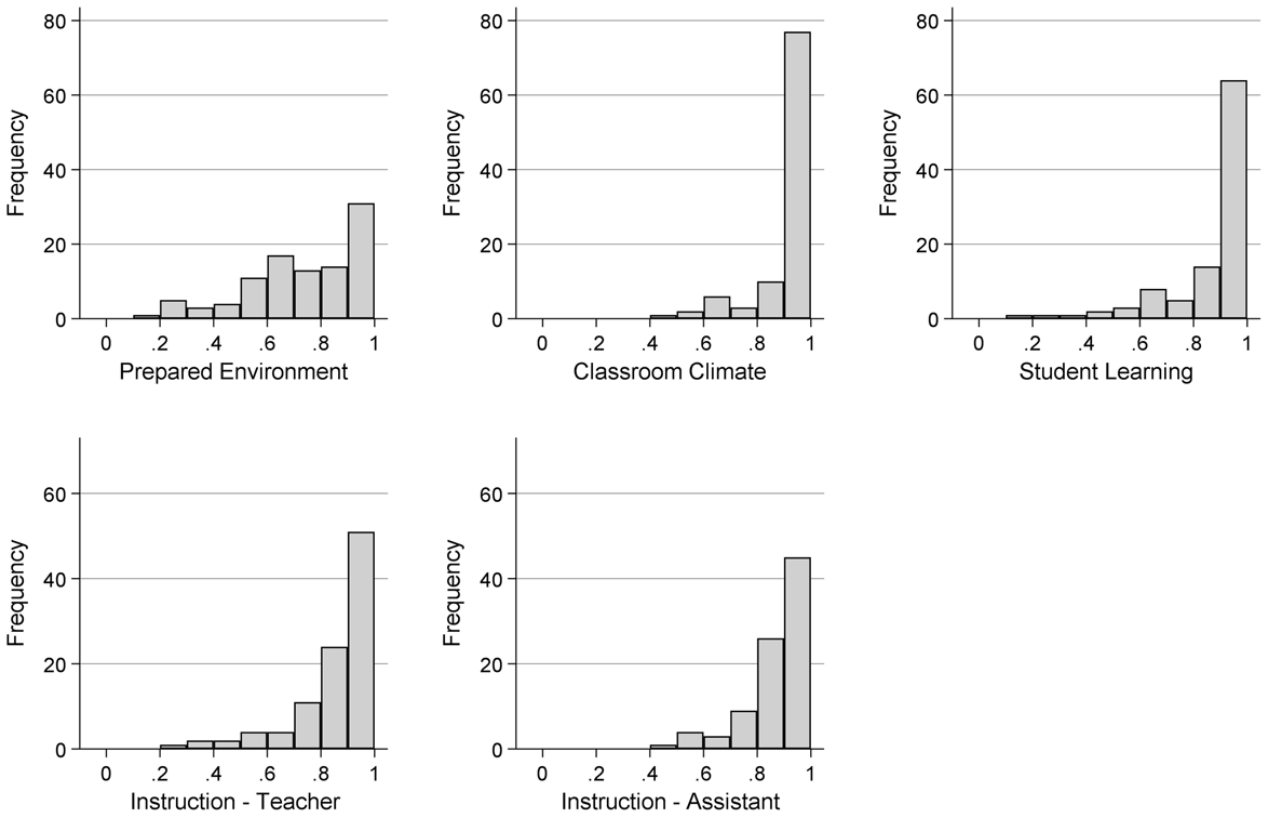


Figure 1
Histograms of Observation Scores

that some Montessori programs do not have the resources to fully implement the Montessori model. Or, it could be that some classrooms simply were not displaying all the available materials are the time of the observation, or had them stored out of view of the observer.

Scores from the teacher interviews are presented in Table 1. Classrooms received average scores of 83% for lesson planning, 79% for record-keeping, and 84% for student assessment. Unlike the observation areas which included multiple items, for these three outcomes, the observers measured items as either met, somewhat met, or not met. For all three factors, approximately 70 percent of classrooms met the standard. For both student assessment and lesson planning, about 27 percent of classrooms somewhat met the criteria and only 3% did not meet them. For record keeping, the results are different. An equal number of classrooms were coded as somewhat met or not met, about 14% each. While most classrooms are doing well on these three dimensions, a number of classrooms are below true fidelity on record keeping.

We also measured fidelity through programmatic

Table 1
Histograms of Implementation Survey Scores.

	N	MEAN SCORE	NOT MET	SOMEWHAT MET	MET	TOTAL
Student Assessment	99	84%	3%	26%	71%	**100%**
Lesson Planning	99	83%	3%	27%	70%	**100%**
Record Keeping	99	79%	14%	14%	72%	**100%**

implementation surveys administered to all principals of public Montessori programs across the state. For the histograms presented in Figure 2, each observation pertains to a Montessori program with scores (0–100%) from the survey averaged across years in which a survey was completed. Data from 52 different Montessori programs are examined here. Using these data, one sees that most programs display a relatively high level of fidelity on these factors. This is particularly true of the Work Period variable for which over 50% of programs scored a 100%, and the Materials variable, 88% of programs received a score above 80%. While the principal survey indicates that Montessori programs have the necessary materials, the classroom observations were a bit more skeptical. The distribution of the Multi-aged Classes variable is more spread out, as there is greater variation in programs on this variable. While 38% of programs scored a 100%, another 28% scored 59% or lower. It is on this dimension that more Montessori programs need to improve to reach higher levels of fidelity.

Research Question 2: Which factors are associated with higher levels of fidelity to the Montessori model in public Montessori schools in South Carolina?

In order examine to the second and third research questions, we created a single, program-level measure of Montessori fidelity. We placed programs in high, medium, or low fidelity categories. Importantly, these are not relative fidelity rankings; rather, programs were compared to the components that were identified as necessary for higher levels of fidelity implementation. These analyses include the 45 Montessori programs for whom we have fidelity data from our observational visits. At the program-level, we found that 23 programs were placed in the higher fidelity category (51% of the total), 14 in the mid fidelity category (31%), and 8 in the low fidelity category (18%). The median observation score for the high fidelity category was 92%. It was 84% for the mid fidelity category and 60% for the low fidelity category. The higher fidelity programs were able to follow the most important tenets of the Montessori model within the public sector. The mid fidelity programs may be similar to the "Supplemented Montessori" programs that Lillard (2012) observed, which combined Montessori education with traditional classroom activities. The lower fidelity programs often lacked appropriate Montessori materials, failed to offer multiage classes, and did not maintain proper record keeping.

We then merged our student-level public student data with our fidelity score ratings.[8] According to data from 2015–16, 7,218 public school students attended a Montessori program that we observed at least at some point over the four years of observation. Table 2 presents data on how high, mid, and lower fidelity programs differ based on student enrollment, the structure of the program, the type of program, and the longevity of the program. On average, Montessori programs enroll about 180 students. However, this number is skewed by the fact that some programs served a very high number of students. When examining the median, or 50th percentile, enrollment in Table 2, we found that the typical program had about 130 students. Enrollment differed by fidelity status. Mid fidelity programs generally had the largest enrollments, followed by high fidelity, and then low fidelity programs. Additional analyses showed that at the low end of the enrollment distribution, there was a diversity of different fidelity levels. Some small programs exhibited high fidelity, while others were mid or low fidelity. In programs with over 150 students, there was much less variation in fidelity scores with most programs being mid- or high fidelity.

Table 2
Program Characteristics by Fidelity Level

	HIGH FIDELITY	MID FIDELITY	LOW FIDELITY	TOTAL
	(N)	(N)	(N)	(N)
Enrollment (mean)	157.9	243.9	108.7	180.0
Enrollment (median)	110.0	257.5	88.0	131.0
	(21)	(14)	(6)	(41)
Whole School	50%	50%	0%	100%
	(2)	(2)	0	(4)
Program w/in School	51%	29%	20%	100%
	(21)	(12)	(8)	(41)
District	51%	29%	20%	100%
	(18)	(10)	(7)	(35)
Magnet/Charter	50%	40%	10%	100%
	(5)	(4)	(1)	(10)
Age of School: 10+ Years	59%	29%	12%	100%
	(10)	(5)	(2)	(17)
Age of School: 4–9 Years	52%	33%	14%	100%
	(11)	(7)	(3)	(21)
Age of School: 1–3 Years	29%	29%	43%	100%
	(2)	(2)	(3)	(7)
Total	51%	31%	18%	100%
	(23)	(14)	(8)	(45)

We were able to examine other program characteristics, as well. Four Montessori programs are whole-school Montessori programs, while the vast majority of Montessori programs with fidelity data in our study have a program-within-a-school structure. This means that a school will have both Montessori and traditional programs. Given the small number of whole-school programs, it is difficult to make true comparisons between the fidelity levels of combination and whole-school programs. Two of the whole school programs are high fidelity, while the other two schools are mid fidelity. There are no low fidelity whole-school programs.

Most public Montessori programs in South Carolina are operated by public school districts. Of the 35 district schools, approximately 18 programs are classified as higher fidelity, 10 programs are classified as mid fidelity, and 7 programs are classified as lower fidelity. Of the ten charter/magnet schools, five programs are higher fidelity, four programs are mid fidelity, and one is lower fidelity.

How long a program has been in place is another program characteristic that was examined. We created three categories. First are well-established programs that had been in place for at least 10 years by the time our study ended in 2016–17 (17 programs, 38% of the total). The second group of programs is established programs that have been in existence for four to nine years (21 programs, 47%). The last type of program are new Montessori programs. These programs had been operating for less than four years, as of 2016–17 (7 programs, 16%). There are stark differences in fidelity levels by age of the program. The older a program is, the greater the likelihood that the program will be considered high fidelity. This could be because as programs become more established, they are better able to focus more resources and attention on ensuring that Montessori is being implemented with fidelity. Alternatively, it is possible that programs that do not exhibit high fidelity do not last as long. On the other end of the spectrum, over 40% percent of all newly created Montessori programs are lower fidelity. Curricular transitions are difficult for administrators, teachers, parents, and students, so it should not be surprising that a significant proportion of new programs are lower fidelity. This finding is not unique to this study, as previous research indicates that challenges with startup charter schools (Sass, 2006; Hanushek et al., 2007). However, young programs can achieve high fidelity. Almost 30% of programs that have been in existence for 1–3 years are high fidelity.

Research Question 3: what types of students have access to high fidelity public Montessori schools in South Carolina?

Previous research indicates that higher fidelity Montessori pedagogy can significantly increase student learning (Lillard, 2012). However, not all public school students have equal access to these programs (Debs, 2019). We found that approximately 42% of public Montessori students attended a high fidelity program, 49% of students attended a mid level fidelity program, and 9% were enrolled in a lower fidelity program. Table 3 shows the fidelity level by the racial and income breakdown of public Montessori students in South Carolina.

Table 3
Fidelity Level by Student Demographics.

		HIGH FIDELITY	MID FIDELITY	LOW FIDELITY	TOTAL
		(N)	(N)	(N)	(N)
# of Students		42%	49%	9%	100%
		(3,024)	(3,542)	(652)	(7,218)
Race	**Black**	42%	42%	16%	100.0%
		(1,012)	(1,024)	(395)	(2,431)
	Hispanic	41%	46%	13%	100.0%
		(184)	(206)	(57)	(447)
	White	41%	54%	5%	100.0%
		(1,620)	(2,133)	(178)	(3,931)
	Other Race	51%	44%	5%	100.0%
		(201)	(175)	(21)	(397)
Low-Income	**Yes**	39%	49%	12%	100.0%
		(1,520)	(1,936)	(466)	(3,922)
	No	46%	49%	6%	100.0%
		(1,503)	(1,605)	(186)	(3,294)

Looking at Table 3, one sees that the proportion of Black, white, and Hispanic students that attend high fidelity programs are quite similar (41–42%). However, Black and Hispanic students are more likely to be enrolled in a low fidelity program than are white students. Students in the other race category are the most likely to attend a high fidelity program; however, this group makes up only 5.5% of the total public Montessori student population.

A concern of many in the Montessori community is that low-income students may not have the same access to high-quality Montessori that high-income students do (Debs, 2019). We looked at the poverty status of students by fidelity level. As seen in Table 3, the plurality of both low-income students and non-low-income students attend programs with medium fidelity, the category with the highest enrollment overall. However, students from low-income families are twice as likely to attend a low fidelity Montessori program (12% vs. 6%).

When looking at other differences, we find that gender and Special Education status do not seem to be related to attending programs with different levels of fidelity. However, there is some evidence that students with English as a Second Language (ESL) status are more likely to be in low fidelity programs (19%) than students without that designation (9%).

Overall, our analysis found that the vast majority of students are attending Montessori programs with higher or medium levels of fidelity. However, important demographic differences are evident in access to higher fidelity programs. Black and Hispanic students were overrepresented in lower fidelity programs. The same is true of students from low-income families and ESL students. While it is true that the majority of South Carolina's public Montessori students, regardless of race, income, or other factors, attend a Montessori program with at least a medium level of fidelity, significant issues remain regarding access to higher-quality public Montessori programs.

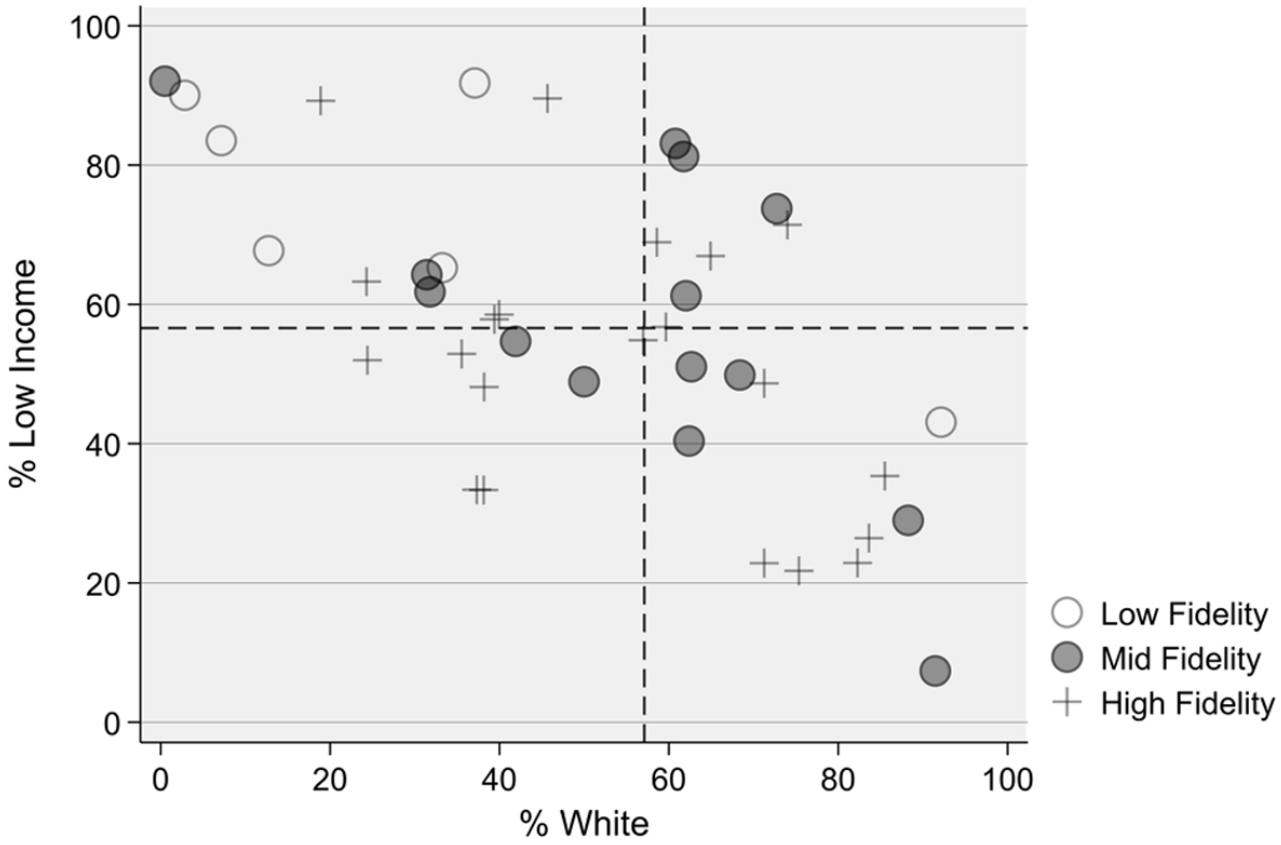
In the preceding analyses, we described student demographics by fidelity level at the student-level. This allowed us to get a sense of the Montessori experiences for public school students in South Carolina; however, from the program-level perspective, the results may be skewed by the fact that some programs have much larger enrollments than others. For the analyses below, we consider student demographics at the program level. This provides a better sense of the average demographics at the program level, but it is important to know that each program is treated the same way in these analyses, regardless of the enrollment in the programs.

Our data allow us to explore the relationship between Title I status as of 2016–17 and fidelity level. Title I schools are high-poverty schools that receive extra funding from the U.S. Department of Education. Twenty-nine of the 45 Montessori programs are in Title I schools. Our analysis reveals meaningful differences. Whereas 75% of non-Title I Montessori schools are classified as high fidelity, only 38% percent of Title I Montessori schools are classified as high fidelity. Further, almost 28% of Title I Montessori schools were characterized as low fidelity, while no non-Title I Montessori school received that designation.

Race and income also are explored in this analysis. Given the well-supported concerns about true access

Figure 3

Poverty and Race by Fidelity Level.



Note: Each symbol represents a public Montessori school. The dashed lines represent the median % low income and % White.

to high fidelity Montessori in the public sector (Debs, 2019), it is very important to examine the relationship between a program's implementation fidelity and its percentages of low-income and white students by program. This analysis is presented in Figure 3.

The dashed lines denote the median percentage of low-income and the median percentage of white Montessori students by program. Using these dashed lines as borders, one can identify four quadrants. The first quadrant in the upper-left-hand corner is for those schools that are above the public Montessori program median in the percentage of students who are low-income and below the median in terms of the white student body. There are thirteen programs in the quadrant. Their fidelity levels are evident by the type of symbol. A significant proportion of these programs are lower fidelity (38%). All but one of the lower fidelity programs are in the quadrant. However, five of the programs in this group (38%) are higher fidelity. Again, educating students from low-income backgrounds may create challenges for administrators and teachers who are in need of additional resources. Nevertheless, higher fidelity Montessori is possible in these situations. The next-most populated quadrant with 13 programs is in the lower right-hand corner. These are the schools with a greater proportion of white students and students from a more economically privileged background. Seven programs in this quadrant are higher fidelity, and five are mid fidelity. This quadrant also includes the only lower fidelity program outside of quadrant one. These results demonstrate that there is no guarantee that programs that have a greater proportion of white students than the average program and fewer low-income students will necessarily provide higher fidelity Montessori.

The remaining programs are in the other two quadrants. The lower left quadrant includes seven schools, five of which are higher-fidelity. This is the largest percentage (71%) of any quadrant. The eight programs in the last quadrant are divided 50/50 into higher- and medium-fidelity. While we find that there

seems to be a program-level relationship between student demographics and fidelity, it is also clear that higher fidelity public Montessori exists in all four quadrants. Student demographics do not fully determine fidelity to the Montessori model.

Conclusion

This paper provides insight into the expansion of Montessori education into the public sector by examining the Montessori environment in South Carolina, a leader in public Montessori education in the United States. Through the analysis of implementation surveys and classroom observations/teacher interview data student record data collected by the state of South Carolina, researchers investigated to what extent public programs in South Carolina were able to implement Montessori education with fidelity to the model, the program characteristics that were related to high levels of Montessori implementation, and which children tended to have access to high fidelity Montessori programs. Findings generally indicated that, despite challenges and tensions created by the education standards and accountability movement, most programs in South Carolina were implementing Montessori with at least a mid level of fidelity. Several characteristics were associated with higher levels of fidelity, including the age of the program. However, findings also indicated that Black, Hispanic, and students from low-income families were disproportionately participating in lower fidelity programs.

Regarding this last finding, researchers previously have examined public Montessori participation by race and income (Culclasure et al., 2018; Debs & Brown, 2017; Debs, 2019). The proportion of students of color and low-income students who participate in South Carolina Montessori programs is similar to state public school averages; however, these students are underrepresented in public Montessori programs when compared to other students in the district (Culclasure et al., 2018; Debs, 2016). These studies have only looked at Montessori participation while ignoring who has access to high fidelity Montessori education. Our study finds that while most students across many demographic categories attend mid or high fidelity Montessori programs, there were inequities. Black and Hispanic students, as well as students from disadvantaged families, were more likely to attend low fidelity programs than were white and higher income students. While previous research indicates that fidelity of implementation is critical to produce more positive student outcomes in Montessori (Lillard, 2012), Montessori school leaders should not overlook the unique contexts in which schools operate. As Debs (2019) notes, it is critical that public Montessori programs consider the needs and preferences of parents and students, especially those from underrepresented backgrounds, when it comes to issues of model fidelity.

Can public Montessori flourish in a standards and accountability world, as is the case in the United States? Schools with an academic focus incongruent with the current accountability movement will face challenges in the public sector. They have to balance adherence to an academic model which is often associated with better student outcomes with the need to adapt and be flexible, which is the key to longevity (Lillard, 2012).[9] Results from our principal survey and teacher interviews indicate that educators indeed are concerned about the number of state and federal mandates and believe that standardized testing requirements raise significant challenges to high fidelity implementation. However, given proper support from district and state officials, most believe that public Montessori can continue to grow and thrive.

While researchers attempted to design a rigorous study with valid and reliable instruments and protocols, there are limitations to this study that must be discussed. A major limitation of this study was the fact that there were no validated instruments at the time of the study to measure implementation program fidelity. Thus, researchers had to create their own tools and protocols, when there was no time or resources to undergo a rigorous validation process. Additionally, it is difficult to classify programs into low, mid, or high level fidelity categories without validated instruments and protocols to create cut-off levels. Another limitation concerns leadership issues as it relates to the principal implementation study results. Our study relied heavily on principals having the knowledge of their school's Montessori program in order to accurately complete the survey. With high rates of principal turnover leading to some principals in schools having little experience with Montessori (Culclasure et al., 2018), it stands to reason that some individuals who completed the survey did not have the deep knowledge about the program to accurately do so. The research team even had principals report that they had no idea how to complete the survey, in which case we asked them to consult with an experienced Montessori teacher or instructional coach. However, this situation likely impacted some of these results.

In this study, we attempted to gauge the possibility of success for the Montessori model in the public sector. In terms of growth and parental demand, it appears

that Montessori can thrive in the public sector. The Montessori curriculum is used in 570 public district and charter schools in the United States. To make it work, school administrators and teachers are trying to meld the Montessori model with the requirements of public schooling in the United States. We find that they have generally been successful, but the fundamental question remains: has the "public school version" of Montessori education positively affected student outcomes? That is a crucial question for public Montessori scholars to answer next and, many researchers, including our research team, currently are engaging in analyses of student academic and behavioral outcomes with a particular emphasis on how these outcomes may differ by level of implementation fidelity. Further, it is critical that researchers do not limit their analyses to the types of outcomes emphasized on standardized tests. Rather, a holistic approach that examines the myriad possible effects that Montessori education can have on children is needed. While many researchers currently are engaging in this work, the fact is that measuring these types of holistic outcomes is extremely difficult. More reliable and valid instruments and protocols need to be tested and made available for researchers to facilitate this process so that these types of critical questions about the impact of Montessori can be answered.

Notes

1. While there are few studies of public Montessori programs (e.g., Brown and Steele 2015; Lillard et al. 2017; Debs 2019; Snyder et al. 2022)there are a variety of early education models and curricula aimed at promoting young children's pre-academic, social, and behavioral skills. This study, using data from the Miami School Readiness Project (Winsler et al., 2008, 2012), the research on private Montessori programs is not much more extensive. See Lillard (2016, Chapter 11) for a summary of recent research.
2. Magnet schools are public schools of choice meant to increase voluntary racial integration. Charter schools are public schools of choice that trade more autonomy from state and local regulations for increased accountability via renewable charters or contracts. Magnet and charter schools often have a curricular theme (e.g., STEM, arts, or Montessori).
3. There are a number of competing Montessori organizations through which a Montessori school can be affiliated. The history of these organizations is rife with internal politics and competition in the United States. Any school is free to identify themselves as "Montessori," as the name is not protected by copyright or patent (Whitescarver and Cossentino 2008, 2592).
4. Before instruments and scoring rubrics were considered final, they underwent an extensive review by the project's Montessori consultant, as well as leaders from numerous national and statewide Montessori organizations, including the American Montessori Society (AMS) and the National Center for Montessori in the Public Sector (NCMPS).
5. The number of Montessori programs included in surveys (N = 53) is larger than sample size used for classroom observations (N = 45). This is because some programs merged or discontinued programming before observations. Further, we used the implementation survey results to learn that some Montessori programs did not meet the minimum threshold for Montessori fidelity, so were excluded from the classroom observation analysis.
6. We had one classroom observation for every 4 classrooms at each grade level. For example, if a program had three early elementary classrooms, we would randomly visit one of them, for programs with 8 early elementary classrooms would visit two, and there would be three classroom observations if a program had 10 Montessori early elementary classrooms.
7. The South Carolina Department of Education uses the PowerSchool database to aggregate student-level demographic information, test score data, and behavioral outcomes information. Student-level data was requested by researchers and provided after an approval process.
8. For four programs, we are unable to examine student-level demographic factors, as we were unable to identify which students participated in the Montessori program in the database.
9. This challenge may be particularly significant for the approximately 5% of charter schools that are converted private schools (Center for Education Reform 2014).

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Competing Interests

The authors have no competing interests to declare.

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