

**Academic Achievement Outcomes:
A Comparison of Montessori and Non-Montessori
Public Elementary School Students**

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Abstract

Within the realm of elementary public schools, several pedagogical models of early childhood education are practiced in the United States (Lillard, 2005). The constructivist approach to early childhood education is illustrative of best practices based on current theory. One model of constructivist early childhood education is the Montessori Method founded in the early twentieth century by Maria Montessori, an Italian physician (Montessori, 1912/1964). Though the Montessori Method is aligned with research-based best practices espoused by constructivism, there are relatively few public Montessori schools currently in the United States. A direct comparison is needed between the academic outcomes of public elementary school programs which implement the Montessori Method and those which implement a more traditional approach to early childhood education. The focus of this study is the academic achievement outcomes of Montessori public school students as compared to similar non-Montessori students. The Montessori students' Iowa Tests of Basic Skills (ITBS) Total Reading and Total Math scores in grades one and two were not statistically different than their non-Montessori counterparts. In grade three, the Montessori students' Texas Assessment of Knowledge and Skills (TAKS) Reading and Math scores were not statistically different than those of the non-Montessori students. In grades four and five, the TAKS Reading and Math scores statistically favored Montessori students.

Keywords: Montessori method, constructivism, public school alternative programs, academic achievement, elementary education

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Introduction

Constructivism in elementary education is based on the idea that students learn best by actively solving relevant problems through a combination of inner reflections and dialogues with teachers and peers (Gordon, 2009). One model of constructivism is the Montessori Method, developed in the early twentieth century by Maria Montessori, an Italian physician (Montessori, 1912/1964). Despite the parallels between constructivist ideals and Montessori practices there are currently relatively few public Montessori elementary schools in the United States. In fact, of the 93,295 public elementary schools in the United States (USDOE, 2007), the American Montessori Society (2011) cites the number of public Montessori elementary schools as slightly over 400. The low ratio of Montessori public schools to non-Montessori public schools is in part due to an absence of information; specifically, achievement data from Montessori students might demonstrate the efficacy of the Montessori Method. A direct comparison is needed between the academic outcomes of public elementary school programs which implement the Montessori Method and those which implement a more traditional approach to early childhood education.

The Montessori Method

The Montessori Method is consistent with a constructivist approach to early childhood education as it has a child-centered focus that fosters the development of both academic and social skills (Lillard & Else-Quest, 2006). The Montessori Method can be described with five constructivist principles, the first of which is that learning be embedded in a complex, realistic, and relevant environment (Zubrowski, 2002). The Montessori curriculum is an integrated series of lessons across a broad spectrum of subject areas connected by narrative (Montessori, 1917/1973). The second principle is the provision of opportunity for social negotiation as well as shared responsibility for learning (Faulkenberry & Faulkenberry, 2006). Within Montessori classrooms, the age range of students and the three-year span of a child's tenure in a classroom allow for collaborative learning (Montessori, 1912/1964). The third principle, support for multiple representations of content (Zubrowski, 2002), is endemic to the Montessori Method as Montessori materials are both broad and deep in scope (Montessori, 1917/1973). The fourth principle is that the constructivist learning environment nurture self-awareness of the construction of knowledge (Alfieri, Brooks, Aldrich, & Tenenbaum, 2011). The freedom of movement encouraged by the Montessori Method provides opportunity for cognition and learning to be intertwined (Montessori, 1912/1964; Lillard, 2005). The fifth principle is that children be given encouragement for taking ownership of their learning

(Faulkenberry & Faulkenberry, 2006). As the Montessori Method prepares the environment for the nurturing of intrinsic rather than extrinsic motivation, encouragement of the child's ownership of his or her learning is a natural fit (Montessori, 1912/1964). The implementation of the Montessori Method allows for a constructivist environment that is a microcosm of the world at large. The current study aims to determine if the Montessori practices are more effective than non-Montessori practices at the elementary school level.

Non-Montessori Education

The current legislation framing public education in the United States, No Child Left Behind (NCLB), is based on maximizing the efficiency of curriculum delivery (Au, 2011; Paige, 2006). There are five basic goals of NCLB. First is an expectation of a return on the public's fiscal investment in public education. Second, academic accountability of the states and districts receiving federal dollars for public education is mandatory. Third, grade level achievement in reading and writing is expected of all students. Fourth, parents have choices regarding the academic environments of their children. Fifth, the American people have high academic expectations for all children. Paige further clarifies that NCLB gives the states latitude to follow the gist of the mandate.

Non-Montessori public elementary classrooms are structured with state standards in mind, and teachers are encouraged to plan according to district curriculum planning guides which encourage a group pace rather than following the needs, abilities, and interests of the individual child (Au, 2011; Lillard, 2005). In a non-Montessori classroom, pacing from lesson to lesson is teacher-directed, with lessons ranging from 20 to 45 minutes and the whole group changing focus at the same time as cued by bells or a teacher prompt (Lillard, 2005). Non-Montessori classrooms are uniformly equipped with child-sized furniture, but students typically are restricted to desks or tables arranged in forward-facing rows (Lillard & Else-Quest, 2006). Currently the vast majority of public elementary classrooms in the United States are non-Montessori (U.S. Department of Education Institute of Education Sciences, 2007; AMS, 2011).

Montessori and Non-Montessori Education Comparisons

The scholarly literature presents some evidence for the both the academic and affective efficacy of the Montessori Method as compared to non-Montessori practices. Positive effects on academic achievement of early Montessori experiences would demonstrate its efficacy. Peng (2009) conducted an empirical study of children in Montessori and traditional elementary schools in China to compare their academic achievement. The researcher examined achievement data in the form of nationally-normed achievement test scores of nearly 200 students, half of whom had attended Montessori preschool and half of whom had attended traditional preschool in Taiwan. Peng examined the test scores of children enrolled in traditional first, second, and third grade classes in the subjects of math, language arts, and social studies. First grade students with Montessori preschool experience had statistically better Chinese language and math scores than those with other preschool experience. Second grade students with Montessori preschool experience had statistically better Chinese language scores than those with other preschool experience. Third grade students with and without Montessori preschool experience had no significant differences in math and social studies achievement scores but slightly better Chinese language scores. At the time of testing, the students were all in traditional elementary schools. The results show a lessening effect as the participants' Montessori preschool experiences were further from the measurement of achievement.

Academic achievement results are not the sole measure of educational efficacy; social skills have also been studied. Lillard and Else-Quest (2006) considered 53 traditional and 59 Montessori students on both academic and social skills measures; the groups were evenly divided among five-year-olds and eight-year-olds. Their measures were a combination of Woodcock Johnston III and researcher-authored measures of social skills. The social skills measures were vignettes presented to the students with choices as to how they would respond. The five-year-old Montessori students scored better than their non-Montessori peers on several of the reading subtests and in some social situations as measured by the researcher-created vignettes. The twelve-year-old Montessori students had stronger creative writing skills than their non-Montessori peers, but reading skills of the two groups were similar. Montessori students who were twelve years old had higher scores on the social skills measures than non-Montessori students.

The studies referenced have described the relatively short term effect of Montessori experiences in preschool and elementary classrooms. Regarding long term effects, there is a paucity of applicable studies. Dohrmann, Nishida, Gartner, Lipsky, and Grimm (2007) compared the achievement data of high school graduates who had attended public Montessori school in grades kindergarten through fifth grade with graduates of the same high school who attended non-Montessori public elementary schools. Participants were matched for gender, race, socioeconomic status, and high school attended. Grade point averages, ACT scores, and state achievement test scores were compared. The results of the comparison indicated that Montessori students had significantly better math and science scores but similar language arts and social studies scores and grade point averages. While this study is a direct comparison of long-term achievement outcomes of Montessori and non-Montessori public students, it is cross-sectional rather than longitudinal and thus measures difference rather than true change.

In another study of the effects of non-traditional early educational experiences on later educational outcomes, Shankland, Genolini, Franca, Guelfi, and Ionescu (2010) completed a longitudinal study of college students from varying alternative early educational experiences. Participants included students with Montessori, Steiner, and New School backgrounds. The dependent variables included measures of academic achievement and both physical and psychological well-being. The conclusion was that alternative early educational experiences were positively correlated to enhanced mental health and academic achievement in college.

While there is some evidence in the literature for the benefits of isolated aspects of the Montessori Method, there is lacking with the exception of Dohrmann, Nishida, Gartner, Lipsky, and Grimm (2007) a rigorous, data-based report regarding the academic achievement of Montessori students as compared to their non-Montessori peers. The metric of the day in these times of No Child Left Behind is the standardized achievement test. This study is an initial step towards quantifying the academic achievement of Montessori public school students and then examining similarities and differences of the academic achievement of non-Montessori peers.

Methodology

The design of this study was a cross sectional comparison of the academic achievement outcomes of Montessori and non-Montessori elementary public school students. The participants, measures, setting, and statistical procedures are discussed in the following sections.

Participants

Participants in this study were 1,035 students from an urban public school district in the Texas. Within this district, two of the campuses were Montessori schools for which students applied for admission. Of the 1,035 participants, 518 were Montessori students and 517 were non-Montessori students. While classrooms at these two campuses were comparable to other prekindergarten through sixth grade classrooms, there were key differences. Both Montessori and non-Montessori classrooms in the district have the same teacher-to-student ratio and the same per-student funding. Both types of classroom were accountable to state and local policy regarding assessment, teacher certification, and curriculum. At the Montessori campuses, however, the prekindergarten through grade six classrooms were equipped with a full array of specialized Montessori materials. In addition to Texas state teacher certification, the teachers at the Montessori campuses either held or were in training for Montessori teaching certification. In the Montessori schools, children were grouped in multi-aged classrooms in the following configurations: primary, lower elementary, and upper elementary. Primary students were in prekindergarten and kindergarten; these classrooms were staffed with a teacher and a full-time teaching assistant. Lower elementary classrooms were for children in grades one, two, and three, and upper elementary classrooms are for children in grades four, five, and six. The demographic features of the participants in this study are presented in Table 1.

In Table 1, *Yes* indicates enrollment in the Montessori program and *No* indicates enrollment in a non-Montessori, traditional program. Participants in this study are not randomly assigned to Montessori or non-Montessori programs. Parental choice and an application procedure are the required steps for enrollment in the public Montessori elementary schools. Enrollment in the public non-Montessori elementary schools is based on residence in a corresponding attendance zone. The participants' races in this study reflect the diversity of the district. To lunch status of each participant was considered to gauge socioeconomic status. The three categories of lunch status were *Free*, *Reduced*, and *Paid*.

Table 1
Participant Characteristics

Grade	Montessori		Gender		Race				Lunch Status			Total
	Yes	No	Male	Female	African American	Caucasian	Hispanic	Other	Free	Reduced	Paid	
1	106	106	100	112	60	56	70	12	56	14	142	212
2	109	109	94	124	62	40	84	32	74	22	122	218
3	98	98	74	122	56	44	82	2	86	0	110	196
4	103	103	76	130	60	42	80	24	66	14	126	206
5	102	101	67	136	48	27	114	14	76	30	97	203
Total	518	517	411	624	286	209	430	64	358	80	597	1035

Measures

For the students in grades one and two, the Iowa Test of Basic Skills (ITBS) (Hoover, Dunbar, Frisbie, Oberley, Bray, Naylor, Lewis, Ordman, & Qualls, 2003) is a nationally-normed achievement test administered in the spring of each year. The ITBS was most recently normed in 2000 with a sample of 170,000 students in the spring and 76,000 students in the fall (Engelhard & Lane, 2011). Engelhard and Lane reported internal consistency and equivalent forms reliability coefficients according to the Kuder-Richardson Formula 20 ranging from the middle .80s to the low .90s. Subtest reliabilities and reliabilities relating to younger children were reported as lower, but overall, reliability was satisfactory. Reading Vocabulary and Reading Comprehension subtests results are combined to produce a Total Reading score, and Math Concepts and Math Computation subtests are combined to produce a Total Math score. For grades one and two in this study, the scores compared were Normal Curve Equivalents.

For students in grades three, four, and five, Texas Assessment of Knowledge and Skills (TAKS) Reading and Math percent correct scores were compared on each of the two tests. The TAKS is a state-developed achievement test administered according to state and district secure protocol. The Texas Education Agency (2011) established reliability and validity for the TAKS. The construct that is measured by the TAKS is the set of learning goals called the Texas Essential Knowledge and Skills (TEKS).

Setting

Both the ITBS and the TAKS were administered according to district mandated protocols by certified teachers in same-grade group settings, typically classrooms. State-certified teachers read from secure scripts and were monitored throughout the testing dates by district administrators to insure that the protocols were strictly implemented.

Procedure

For each grade level, the most current data were from the 2011 administration of the ITBS for grades one and two and the TAKS for grades three, four, and five. While the total number of participants was 1,035, there were approximately 100 Montessori and 100 non-Montessori students at each grade level.

The statistical analysis for this project involved several steps. Multiple regressions were conducted to remove the effects of gender, race, prior academic achievement, and socio-economic status. Prior academic achievement was determined by each participant's achievement scores on the same measures from the prior year. Socio-economic status was determined by free, reduced, or paid lunch assignment. For grades one and two, the dependent variables were Total Reading and Total Math Normal Curve Equivalent (NCE) scores on the ITBS. For grades three, four, and five, Reading and Math percent correct on the TAKS Reading and Math subtests were the dependent variables. A residual score was saved and, for easier comparison, was converted back to an NCE-like score for ITBS tests and a percent-like score for TAKS tests. The new scores were then used in a one-way ANOVA using a .05 significance level. The independent variable for each analysis was school type, Montessori or non-Montessori, and the dependent variable was the residual test score. Separate analyses were conducted by grade and subject.

Results

For each grade and subject, the residual scores of Montessori and non-Montessori students were used in a series of one-way ANOVA at the .05 significance level. The means and standard deviations are presented in Table 2. The ANOVA statistics are presented in Table 3. Figures 1 and 2 present the academic achievement outcomes for grades 1 and 2 and grades 3, 4, and 5 respectively.

Table 2
Academic Achievement Scores by Grade and School Type

		Montessori Mean(SD)	Non-Montessori Mean(SD)
Grade 1	Total Reading NCE	49.01(21.03)	50.98(21.16)
ITBS	Total Math NCE	48.89(23.67)	51.10(23.80)
Grade 2	Total Reading NCE	52.86(19.80)	47.39(21.93)
ITBS	Total Math NCE	51.97(13.66)	48.20(15.13)
Grade 3	Reading Percent Passing	78.62(16.57)	75.39(24.29)
TAKS	Math Percent Passing	70.19(14.12)	68.58(22.13)
Grade 4	Reading Percent Passing	80.93(13.35)	73.83(23.20)
TAKS	Math Percent Passing	76.72(11.38)	70.67(19.77)
Grade 5	Reading Percent Passing	80.91(12.29)	73.03(24.34)
TAKS	Math Percent Passing	76.96(10.88)	69.98(21.55)

Table 3
ANOVA Result for Academic Achievement Analyses by Grade and Subject

		<i>F</i>	<i>p</i>	²
Grade 1 ITBS	Total Reading	.397	.529	.002
F(1,182)	Total Math	.397	.529	.002
Grade 2 ITBS	Total Reading	3.035	.083	.017
F(1,177)	Total Math	3.035	.083	.017
Grade 3 TAKS	Reading	1.130	.289	.006
F(1,183)	Math	.371	.543	.002
Grade 4 TAKS	Reading	7.182	.008	.034
F(1,204)	Math	7.182	.008	.034
Grade 5 TAKS	Reading	7.977	.005	.040
F(1,192)	Math	7.977	.005	.040

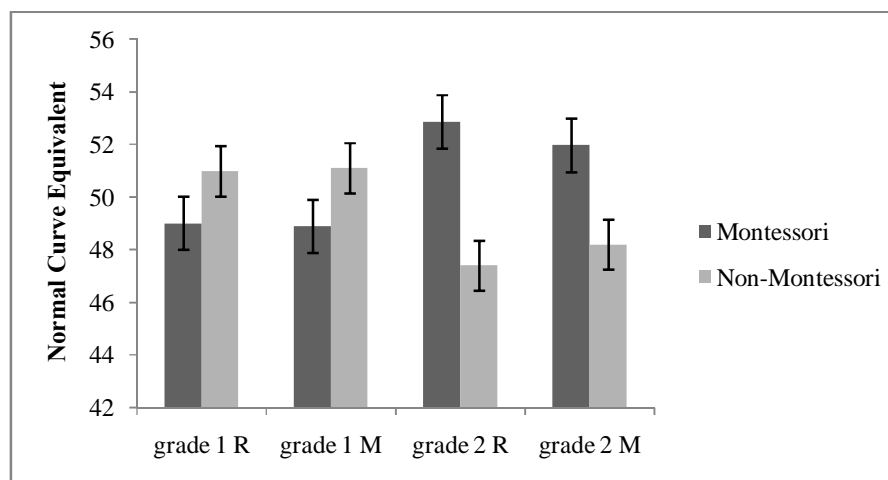


Figure 1 Grades 1 and 2 ITBS Achievement NCE Scores

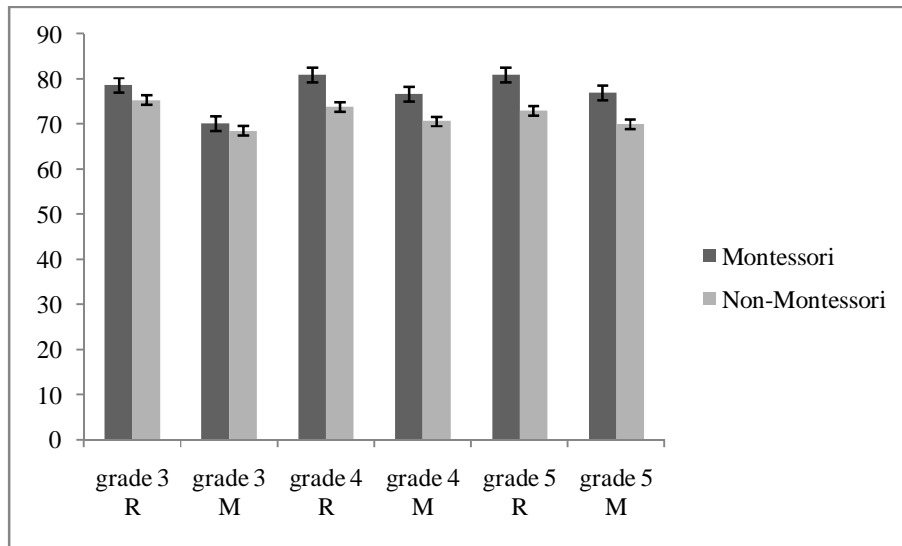


Figure 2 *Grades 3, 4, and 5 TAKS Percent Correct Scores*

Discussion

At the two public Montessori schools whose data were accessed for this study, 50% of the incoming students in grade one were new to the Montessori program. The achievement tests were administered in the spring of each school year. Therefore, grade one achievement test scores reflected the results of seven months of Montessori or non-Montessori instruction. In grade one, the academic achievement of Montessori and non-Montessori students was not significantly different. In fact, the mean score for non-Montessori first grade students was slightly higher than Montessori students on both the ITBS Total Reading and Total Math scores.

At the two public schools whose data were accessed for this study, less than 10% of the incoming students in grades two and three were new to the Montessori program. Achievement scores thus reflect nearly two years of Montessori instruction at grade two and nearly three years of Montessori instruction at grade three. While Montessori and non-Montessori results at grades two and three were not significantly different, they slightly favored Montessori instruction.

In grades four and five, approximately 5% of the students were new to Montessori. Therefore, fourth and fifth grade Montessori students had received fairly consistent Montessori instruction for several years prior to the administration of the TAKS tests. In grades four and five, Montessori students had statistically significantly better TAKS Reading and Math scores than their non-Montessori counterparts though the effect size was small.

The results of the current study are similar to the findings of Lopata, Wallace, and Finn (2005), whose younger participants demonstrated no significant differences in achievement but whose older participants showed divergences. Lopata et al., showed no statistical difference among fourth grade Montessori participants' language arts and math scores and any of the comparison groups. Among the eighth grade participants, Montessori students had lower language arts scores and similar math scores. This pattern contrasts with the current study in that the divergence in the current study favored Montessori students in both reading and math achievement scores at the fourth and fifth grade levels.

Among students who experienced Montessori preschool, Peng (2009) found that the differences between Montessori and non-Montessori achievement were greater for first graders than third graders. While this finding might appear to be in contrast with the current study, the participants in the Peng study were not enrolled in Montessori elementary schools at the time of their achievement testing. Thus, the Peng study might demonstrate that the effects of a Montessori preschool experience diminish over time spent in a non-Montessori classroom. In the current study, the participants had continued in a Montessori elementary program through the time of the administration of the measures.

Lillard and Else-Quest (2006) found that Montessori students had higher academic skills than non-Montessori counterparts, and this finding paralleled the findings of the current study. However, their sample size was small and the measure of academic achievement was a series of individually administered tests. The larger sample size of the current study lends power to the Lillard and Else-Quest findings. This observation is also true of the Ervin, Walsh, and Mecca (2010) study as the measures used in the current study were norm-referenced and the sample sizes were comparatively large.

Dohrmann, Nishida, Gartner, Lipsky, and Grimm (2007) compared high school students with and without preschool and elementary Montessori experience. They found higher achievement for Montessori students than non-Montessori students in math and science but not in language and social studies as measured by grades, ACT scores, and state achievement tests. While the current study found higher reading and math scores, it did not measure social studies or science. Both the explanations for similar language achievement levels and comparisons for science and social studies results are areas for further study.

Limitations

There were three primary limitations of this study. The first concerns the measures used in this study: the ITBS and the TAKS. Consistent use of a single measure is preferable. The second limitation is that students were not randomly assigned to Montessori or non-Montessori programs. As parental involvement is positively correlated with academic achievement (Graves & Wright, 2011), the fact that the Montessori students in this study were enrolled because of the effort of their parents is a potential confound. A possible means of addressing this issue in further studies is to compare the academic achievement of students from the Montessori schools to that of students who applied and were eligible for admission, but were placed on a waiting list due to space constraints. The third limitation is the question of treatment fidelity. In this study, the Montessori classrooms were public. Lillard (2012) compared academic and social outcomes of young children who had experienced classic Montessori, supplemented Montessori, and non-Montessori instruction and found that the most favorable outcomes resulted from classic Montessori instruction. Because the district's Montessori program is administered in public schools, there are state-mandated objectives, the Texas Essential Knowledge and Skills (TEKS) (TEA, 2011) that must be addressed within the classrooms. That the public Montessori classrooms include non-Montessori curricular elements is a confound.

Implications

Implications of this study include the observation that the gap between the academic achievement of Montessori and traditional students widens in favor of Montessori students as the number of years in Montessori education grows. It could be that time in the Montessori classroom is the factor that leads to significant differences. The impact of Montessori education on academic achievement might be a cumulative effect which comes to fruition with sustained time in a Montessori classroom. In particular, the results of this study suggest that consistent, comprehensive tracking of the academic achievements of Montessori students across the span of their school years is needed.

A topic regarding Montessori education unaddressed in this study is the social benefit of a Montessori education. The affective outcome comparisons of Montessori and non-Montessori educational experiences are beginning to receive attention in the literature. Further work exploring affective and social effects of Montessori education with diverse populations and older children is warranted.

There are strong parallels between the Montessori Method and constructivism. Learning embedded in meaningful context, multi-aged classrooms, multiple representations of content, intrinsic motivation, and freedom of both physical and curricular movement are aspects of the Montessori Method with empirical bases for claims of efficacy. This study demonstrates that the academic achievements of public school elementary-aged students who participate in Montessori programs diverge favorably from those of non-Montessori students. This divergence becomes statistically significant in later elementary grades. As upper elementary students in the Montessori public school program are experienced Montessori students and are rarely new to the program, an implication is that longer time in a Montessori program yields significant academic achievement. The long-term effect the outcomes of education in a Montessori classroom is an area for further study.

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