
This study supports the hypothesis that Montessori education has a positive long-term impact.

Although the Montessori and Peer Control groups both performed well on GPA and on the English/Social Studies scales, they did not significantly differ on these. As noted, the effect of a Montessori education on GPA approached statistical significance. Because GPA was unweighted, further analyses will take into account the impact of honors courses, tracking, the type of high school attended, etc.

The lack of statistical difference on English/Social Studies could reflect a number of possible factors. It may be that in the teaching of these cognitive skills there is overlap between Montessori and more traditional programs (perhaps to a greater degree than for Montessori mathematics and science). In addition, it is possible that families generally may be better at facilitating language and social studies skills (through books, conversation, and opportunities for enrichment) than they are at stimulating the cognitive skills of mathematics and science. Thus, for English and Social Studies, family environments may outweigh school environments; for Mathematics and Science, the Montessori school environment may assume a larger role. These are, of course, speculations.

It is important to be cautious when interpreting these results. Children were not randomly assigned to Montessori or non-Montessori groups. This is true despite the fact that selection for the Montessori


schools was made via lottery. Because the design is not a true experiment, we cannot completely rule out other possible influences (for example, parent and family characteristics).

There are several significant aspects of this study. The outcome measures used were not those particular to a Montessori program, but rather were the standard achievement measures and records of a public school system. The outcomes were longitudinal in nature, assessed five or more years after the students left their Montessori environments. The peer control group design established common high school experience for both groups and allowed for statistical control of relevant demographic characteristics. This comparison held the Montessori students to a high standard. In contrast to most previous research, the Montessori programs themselves were well documented and implemented.

This study supports the hypothesis that Montessori education has a positive long-term impact. Additionally, it provides an affirmative answer to questions about whether Montessori students will be successful in traditional schools.

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Kathryn Rindskopf Dohrmann prepared this report for the members of AMI/USA, May 2003.

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Outcomes

for Students in a Montessori Program

A Longitudinal Study
of the Experience in the
Milwaukee Public Schools



Association Montessori
International / USA

Introduction

Montessori programs have grown considerably over the past decades. There have been two major facets to this growth: expansion from private to public settings and extension from preschool into elementary, junior high school, and beyond. Growth has brought concerns about outcomes, especially academic ones. In particular, there have been questions about the performance of Montessori students when they move on to more conventional academic settings. This research addresses these questions.

The current study compares the academic outcomes of two groups of students who graduated from the high schools of the Milwaukee Public Schools (MPS) during the years 1997-2001. The first group includes students who completed the 5th grade in Montessori programs at MacDowell and Greenfield schools during the years 1990-1994. The second group was a matched sample of graduates from the same high schools who did not attend Montessori schools. The MacDowell and Greenfield Montessori programs were established as public magnet schools in the mid-seventies and have consistently striven toward a high level of Montessori practice.

This study represents a convergence of interests on the part of AMI-USA, the American branch office of the Association Montessori Internationale (AMI), and the leadership of the Milwaukee Public Schools (MPS). The immediate interest of the MPS was the desirability of increasing the number of Montessori schools within its system. AMI-USA saw the necessity of high quality research, designed to address mainstream issues of accountability. Both organizations believed it was essential to document and evaluate outcomes for students who had participated in the MPS Montessori programs. NCERI (The National Center on Educational Restructuring and Inclusion, the Graduate School and University Center, The City University of New York) was engaged to conduct this study.

Context

Many Montessori schools evidence high achievement levels. Such results, though impressive, can be difficult to interpret for a variety of reasons. These schools may contain large proportions of children from high socioeconomic backgrounds who might be expected to show strong academic achievement regardless of type of schooling. It is also difficult to rule out the influence of parental motivation, in that Montessori schools may attract families who are particularly committed to and involved with education.

Researchers have tried to address these issues in a modest number of Montessori outcome studies. Although most studies have been non-experimental, a few were carefully designed as true experiments, with random assignment to programs, control groups, and blind assessment practices. Some included longitudinal follow-ups. Despite care in design and the great effort required to “recover” subjects, almost all of the research is handicapped by extremely small sample sizes—samples

that grew even smaller with attrition. Furthermore, many of these studies are decades old.

Another important issue in research on Montessori outcomes is the integrity of the relevant Montessori programs. Many of those studied offered only one academic year of Montessori experience, with classrooms of undocumented quality. Even when documented they appeared to be sub-optimal, representing a “lower bound” of Montessori implementation.

There is a need for up-to-date, carefully constructed, long-term studies of the outcomes of Montessori education. In the process, elucidation of the integrity of Montessori implementation is essential. Only then can accountability questions be addressed.

The Current Study

An initial step was to survey the MPS Governing Councils, composed of staff, parents, and community members at MacDowell and Greenfield. With the survey results in mind, the current research focused on data available from the MPS archives. The findings presented in this report are based on scores from the ACT and the WKCE (Wisconsin Knowledge and Concepts Examination, a form of the nationally standardized Terra Nova, administered in the 10th grade), as well as on overall and subject-specific high school grade point averages (GPAs).

The Montessori sample consisted of 201 students who had (a) begun their Montessori education at age three or four in the MacDowell or Greenfield Montessori schools; (b) completed the fifth grade between 1990 and 1994 at MacDowell or Greenfield; and (c) maintained active status within the MPS throughout high school. The graduation years of 1997-2001 were chosen because the MPS central record system generally had been systematized by that time.

Figure 1

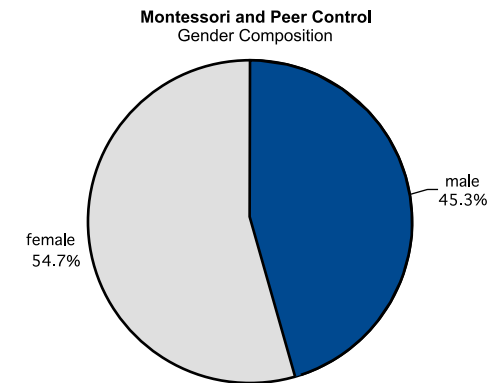
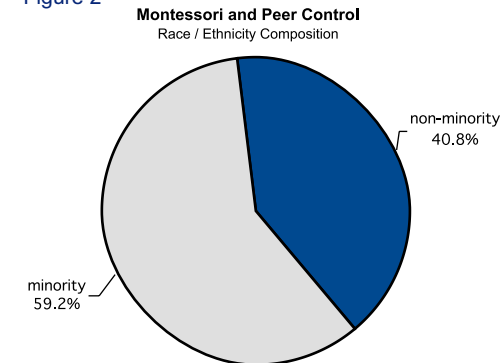


Figure 2



Montessori students and Peer Control students were carefully matched

by gender, race/ethnicity, and socio-economic status (using eligibility for free or reduced lunch as a surrogate). Both groups had a gender composition of 54.7% female and 45.3% male, and a racial/ethnic composition of 40.8% non-minority and 59.2% minority. Approximately 5% of each group had applied and qualified for free or reduced lunch.

As a further control, the Montessori and Peer Control students were matched by the high school they had attended.¹ The wisdom of controlling for high school experience became especially evident when records revealed that more than half of the Montessori sample had attended the four most highly rated and selective high schools in the MPS system (including, for example, a college preparatory high school, an International Baccalaureate school, and a school for those talented in the arts).

The gender and race/ethnicity compositions of the Montessori and Peer Control groups are shown in Figures 1 and 2.

Results

The first step in data analysis was to assess the interrelationships among ACT scores, WKCE scores, and GPAs. Because these are all related to academic performance, they tend to be highly correlated. Factor analysis was used to determine the underlying structure of the twenty-three available scores (e.g. ACT Composite as well as subscales). Three factors were identified: GPA, Math/Science, and English/Social Studies. The Math/Science and English/Social Studies factors reflected the relevant standardized test scores from both the ACT and WKCE. GPA reflected overall and subject-specific high school grade point averages.

With the factor structure established, the predictive effects of several variables were considered using structural equation modeling. Students who had participated in the Montessori program significantly outperformed the Peer Control group on Math/Science scores. Montessori and Peer Control students were not significantly different on English/Social Studies scores or on GPA (though performance on the latter favored Montessori and approached significance).

Table 1: Predictors of Academic Performance

Predictor	Factor		
	GPA	Math/Sci	Eng/Soc Studies
Montessori		* + Montessori	
Gender	* + Females		
Minority	* - Minority	* - Minority	* - Minority
Free Lunch	* - Free Lunch		

(*) indicates a significant effect at the $p < 0.05$ level²
(+ or -) indicates the direction of the effect by group
An empty cell indicates no significant effect.

Other findings included the following: gender had a significant effect on GPA, with females outperforming males; non-minority students significantly outperformed minority students on GPA, Math/Science, and English/Social Studies. Students who were in the free lunch program scored significantly lower on GPA than students who were not. No interactions were significant. All of these results are summarized in Table 1.

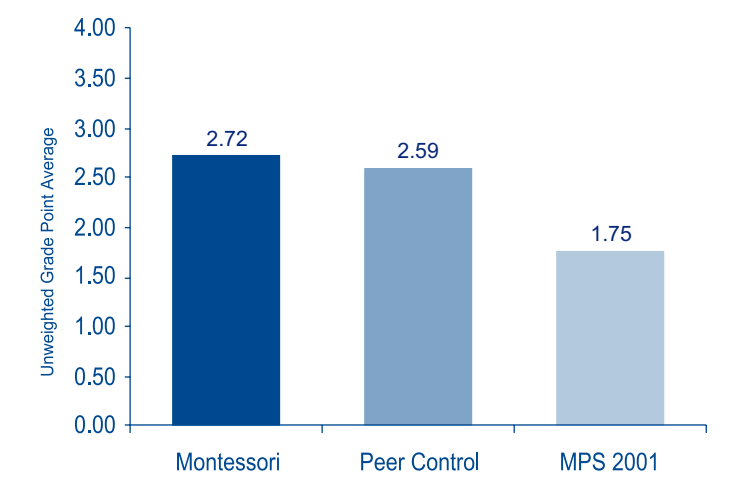
Discussion

A significant finding in this study is the association between a Montessori education and superior performance on the Math and Science scales of the ACT and WKCE. In essence, attending a Montessori program from the approximate ages of three to eleven predicts significantly higher mathematics and science standardized test scores in high school.

This result is educationally important for a number of reasons. It was found five to seven years after the students had exited the Montessori programs and enrolled in traditional public schools. (Effects of “intervention” programs most often disappear a year or two after students return to regular schooling.) The findings have particular relevance because: (a) the Montessori students had been matched to the comparison group on variables commonly predictive of school performance (gender, race/ethnicity, and socio-economic status), and (b) the comparison students were drawn from the same high schools as the Montessori students (with more than half of the sample attending the most selective of the MPS high schools).

Both the Montessori and Peer Control students evidenced strong academic achievement—shown in Figure 3 by overall GPAs—relative to their counterparts in the MPS. This comparative strength was found for all dimensions of academic performance. In this context, the fact that the Montessori students had significantly higher Math/Science scores suggests a substantive impact of their Montessori experience.

Figure 3 Comparison of Overall GPAs



¹ Data on middle school attendance for both groups, and on preschool attendance of the Peer Control students, were not available.

² Indicates a statistically significant effect at the .05 level; statistical significance is said to exist when the probability that the observed findings are due to chance is very low.