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ABSTRACT

This study was initiated to make a preliminary evaluation of the effects of Montessori education when children continued with the same method in public schools that they experienced in prekindergarten. Subjects were 72 black 5- and 6-year-olds from lower-middle and lower economic class families. There were two experimental classes in nongraded primary classrooms. One experimental group had Montessori preschool experience; the other, Head Start. Two control groups had conventional public classroom experience. One control group had experienced Head Start; the other had no formal preschool education. In a multiple-assessment procedure, children were measured according to ability (1) to create novel solutions to a maze puzzle; (2) to match appropriate objects among a sample of 3; (3) to separate an item from the field or context of which it is a part; (4) to control and restrain impulse action (Draw-a-Line-Slowly); (5) to repeat sentences (WPPSI); and (6) to initiate investigative behavior (curiosity measures.) Findings indicated that the non-graded primary combined with preschool experience showed the best results; subtracting either preschool or non-graded practices reduced the progress of the children. (AJ)

The Sands School Project:

First-Year Results

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Background and Summary

Late in 1966 the Sands Project originated in discussions between representatives of the Cincinnati Board of Education, the Carnegie Corporation of New York and the Cincinnati Montessori Society, together with members of the Montessori Research Project in the Department of Psychology, University of Cincinnati. By fall of 1967, funding had been provided by Carnegie. The Sands School in Cincinnati's West End (a Negro ghetto) and its Principal, Mr. Saunders, guaranteed cooperation with the research goals.

The research design called for a Montessori-trained teacher provided by the Cincinnati Montessori Society and a non-Montessori teacher provided by the Board of Education. Both these teachers were to be given freedom to carry out their instructions in their own style, at their own pace, using any techniques they saw appropriate in their conception of a non-graded primary classroom. Both groups had pre-school experience; Montessori for the former, Headstart for the latter. In addition, two groups of control children were selected from a kindergarten class conducted as a conventional public school classroom. Within that class, one subgroup had experienced pre-school Headstart training; the other subgroup did not have benefit of formal pre-school education.

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[1] Mr. Herbert Bilick and Mrs. Bonnie Green were responsible for testing and preliminary data summaries, all done efficiently and professionally. Miss Karen Brazis did most of the statistical calculations; her work was always done punctually and accurately. I want to thank them all for their excellent contribution to this first year's work.

[2] Currently on academic leave for the school year, 1967-68, as Visiting Professor of Social Psychology, Makerere University College, Kampala, Uganda, in East Africa.

The purpose of this design was to make a preliminary evaluation of the effects of Montessori education when children were given a chance to continue with the same method in public schools that they had become accustomed to in pre-kindergarten. The non-Montessori non-graded primary made it possible to see if continuity in Montessori education would have an effect over and above possible benefits accruing to non-graded primary instruction. The two control groups within the conventional public school graded classroom permitted assessment of the potential gains over children who had no benefit of non-graded primary education, and (in the other sub-group) who had no benefit of pre-school education.

The tests for evaluation were selected to represent a range of cognitive, sensorial, and behavioral functions. To measure only innovative behaviors might reveal advantages only in one group; to measure only conventional intelligence might bias the results in favor of another educational group. Where one educational method is strong, another might prove weak. This philosophy of evaluation allows for more complex and subtle outcomes to emerge, whereas presumed unidimensional assessment procedures (like conventional IQ) permit only simple conclusions which might handicap otherwise beneficial practices.

While this multiple-assessment procedure did in fact result in somewhat complex patterns, the general configuration of the obtained test scores went like this: Montessori continuity from pre-school to primary grades did best, but non-Montessori continuity from preschool to primary grades did very nearly as well; a group of children who received no preschool exposure and who then went on to a graded primary class did poorest; finally, another group, with preschool experience but graded primary exposure showed results intermediate between the non-graded classes and the poorest group that did not have pre-school.

In summary, the non-graded primary combined with pre-school experience (Montessori or not) showed the best overall results; subtracting either pre-school or non-graded practices reduced the progress of the children.

From the point of view of Montessori philosophy, one is impressed more with the similarities between the non-graded primary classes than with the differences. If Maria Montessori were to see the very skillful work of the so-called "non-Montessori" non-graded class, she would very likely endorse its freedom for the children (moving about; working alone); its planned environment (innovative methods with tape recorder playback of children's conversations; live animals, etc.); its non-punitive character (an "incorrect" answer deserves help, not anger; original answers are reinforced, but other answers are pursued); and its emphasis on concentration (the children sustained activity without direct supervision for relatively long periods of time). This class was more teacher-oriented than Montessori might perhaps approve of, since there were frequent group lessons and little equipment that emphasized individual effort. Thus, there is reason to believe that many aspects of Montessori thinking can be incorporated into any good teacher's personal style in a useful way.

The Montessori continuity group had, since pre-school, exposure to a relatively indirect teaching method combined with materials that were well suited to individual work. Whatever slight edge the group had in our study might be tentatively attributed to this feature.

The specific results were important as the overall outcome. The significant advantages of the non-graded primary groups showed up not only in terms of innovative behavior, but even more strongly in what we call conventional intelligence measures: the ability to repeat sentences accurately after hearing them read just one time; or the ability to match objects which are conventionally thought to "go together" like a gun and holster, or a bottle with a baby. This was important in terms of the children's ability to <u>shift</u> from conventional functioning to innovative functioning. Such shifting ability gives the child flexibility in his attack upon problems; he can draw on traditional, culturally sanctioned answers or he can move out with novel solutions when the task demands it. This is a key idea in

the theory of autonomous functioning (Banta, 1968; Hartmann, 1939, 1947), which this author has defined as "self-directed behaviors that facilitate effective problem solving.

The remainder of this report will provide more technical detail about the procedures and about the obtained data. Readers who need even more explicit statements about the tests themselves, scoring procedures, and administrative matters are invited to write the author or to consult my description of the Cincinnati Autonomy Test Battery (Banta, 1968).

Procedure

Controls. Children were selected for participation in this study with the goal of controlling for age and sex factors. All children were Negro. The only other selection factor was that Montessori children were drawn from two sources, Sands School area, and the other from a Montessori school located about four miles away from Sands. This bussing was necessary since not all local Montessori children were of required age to enter public school kindergarten.

Table 1 summarizes the results of matching on age and sex. The mean age is slightly lower for the control groups and for this reason additional precaution has been taken in the statistical analyses to further control for any bias resulting from failure to completely match this factor.

In each group there were slightly fewer boys than girls. Percent males ranged only from 42% to 47% from group to group.

Thus we are confident that racial factors, sex, and age (with statistical controls in later analyses) are ruled out as possible explanations of obtained differences. Economic factors are well controlled also. All children with the exception of part of the Montessori sample, were from the Sands School area, made up of lower middle and lower class families, and once age and sex was determined, were assigned at random to the various classes. The Montessori group that had been bussed in were from slightly lower income families located in public housing apartments.

Table 1

Average Age and Percent Males in Each of the Four Groups Studied

	Experimental Non-Graded Primary		Kindergarten Control	
	Montessori	Non-Montessori	With Preschool	Without Preschool
N	19	19	19	17
Mean age (yrs)	6.1	6.2	6.0	5.8
Percent Male	47	42	42	47

Testing: Two testers, a male and a female, both white, administered the test materials individually. Children were tested in March and May of 1968. Order of testing was on a systematic pre-assigned basis so that assessment for all groups would be distributed equally throughout the testing period, and so that each tester tested approximately equal numbers of boys and girls.

Tests and Test Results

Below, each of the tests will be described briefly along with a short analysis of the task demands of each test and the kinds of classroom procedures that might parallel test performance. Following each test description, the obtained data for each of the four groups of children will be presented. Each section will be concluded with a discussion of the outcome in relation to classroom practice and child development. There were eight tests and ten scores derived from them. The statistically reliable findings will be discussed first followed by the less reliable test results.

Matching From Sample: Measures ability of child to match the "appropriate" object among a sample of three objects. E.g., when given a gun, a holster is the appropriate match, rather than a pair of scissors or a key. Requires the child to sit still, listen carefully to verbal instructions, scan materials, compare, and draw on conventional cultural knowledge, communicate choice to tester.

Results - Matching from Sample

Montessori, Non-Graded	14.47
Non-Montessori, Non-Graded	14.11
Control, with Pre-school	12.42
Control, without Pre-school	11.00

$F_{Cov} = 5.6, p < .01$[3]
$F = 6.02, p < .005$

[3] Analysis of covariance (with age as the covariate) has been calculated for all analyses in addition to a simple analysis of variance, because of the slightly lower average age of the Control without Preschool group.

Montessori children obtained the highest average score, but was followed closely by the Non-Montessori experimental group. Both controls fell below the experimental groups, and these differences were statistically significant at p .05.[4] Thus the non-graded classrooms showed an advantage in producing culturally conventional answers. As a consequence, the fear that a permissive environment may lead to freedom but not conventional discipline was not supported here. A permissive situation with freedom to move about to do interesting, instructive things (the planned environment) lead to good conventional learnings.

Dog and Bone Test: Measures Innovative Behavior, or tendency to generate alternative solutions to problems. Consists of game of "getting the dog to his bone" by various routes. The child is shown two paths the dog might take to get to his bone; then he is asked to find another way for the dog to get to his bone. The child is given ten opportunities to "find another way." Only novel responses are scored. Requires the child to sit still, listen to simple instructions, then produce new responses on his own.

Results - Dog and Bone Test

Montessori, Non-Graded	7.63
Non-Montessori, Non-Graded	7.58
Control, with Pre-school	5.63
Control, without Pre-school	4.41

$F_{Cov} = 1.7$, $p < .25$

$F = 3.31$, $p < .05$

When age differences were controlled (F_{Cov}) on this variable differences were not highly significant on a statistical basis. The pattern of data however, resembled closely that of other variables that were significant. When comparison is made between the experimental groups and the Control without Pre-school, those differences were reliable. Thus in the realm of Innovative Behavior, the non-graded primary groups again show an advantage, although less strongly, and age differences accounted for part of the effect.

[4] When differences between groups are discussed, statistical reliability is based on the Duncan Multiple Range test.

Early Childhood Embedded Figures Test. Measures Field Independence, the tendency to separate an item from the field or context of which it is a part. Figure to be located in the embedded context is shaped like an ice-cream-cone. Child instructed to "Put our cone on top of the cone on this page," where the "cone" is part of a drawing of a tree, or a cowboy's face, etc. Careful training precedes testing, which minimizes verbal comprehension requirements, but attention, sitting still, scanning materials are necessary; in addition, test involves new perceptual learning specific to this variable, rather than conventional cultural responses as in the Matching from Sample test. Requires analytic thinking, perceiving.

Results - EC-EFT

Montessori, Non-Graded	11.37
Non-Montessori, Non-Graded	11.26
Control, with Pre-school	11.21
Control, without Pre-school	8.94

$F_{Cov} = 3.3$, $p < .05$

$F = 4.5$, $p < .01$

Here again, Montessori children obtained highest average score, but Non-Montessori and the Control with Pre-school means were very similar. All three top groups differed reliably from the Control without Pre-school. Pre-school was the critical variable, since where it was present, scores were elevated. The instructions in this test are highly developed and do not require verbal comprehension to the degree many tests do. This suggests that early learning may affect performance on analytic thinking problems where verbal factors are minimized. It will be important to follow this up in next year's testing to see if this no-pre-school deficit is cumulative.

Draw-a-Line-Slowly. Measures motor impulse control, or the ability to control and restrain impulsive action, when the task demands it. In this test, after training the child to know the difference between very fast and very slow lines, the child is asked to "...draw a line just as slooowly as you can," three times in

succession. The lines are timed and later the rate at which the lines are drawn is calculated. The faster the rate, the more impulsive; the slower the rate the better the motor impulse control. Requires the child to sit still, follow instructions, in a situation that has little cognitive content. Emphasis on obedience in a simple request-situation.

Results - Draw-a-Line-Slowly

Non-Montessori, Non-Graded	.29
Montessori, Non-Graded	.32
Control, without Pre-school	.43
Control, with Pre-school	.49

$F_{Cov} = 11.0$, $p < .005$

$F = 2.50$, $p < .10$

Most Impulse Control (lowest rate of line-drawing) was shown by the Non-Montessor, Non-Graded group and was followed closely by the Montessori experimental group. Thus while these two were numerically reversed from previous analyses above, they were not significantly different from one another and both showed better Impulse Control than the two non-experimental groups. Thus on a task demanding obedience and good self-control the more permissive, non-graded classes showed the best outcome, supporting the view that it is not necessary that children work in a group, or conform to curriculum demands on a uniform basis in order to attain motor impulse control, or other conventional disciplinary habits.

Repeat Sentences. Borrowed from the Weschler Pre-school and Primary Scale of Intelligence (WPPSI). First short sentences, then increasingly longer sentences are read to the child with instructions to repeat exactly what the tester says. Parallels many conventional schoolroom practices which require the child to sit and listen carefully, to repeat back exactly what is said, and to add no innovative material. The test correlates well with other WPPSI measures of conventional intelligence which usually predict conventional school success (although this test has not been tried out thoroughly in this way yet).

Results - Repeat Sentences

Montessori, Non-Graded	11.63
Control, with Pre-school	10.47
Non-Montessori, Non-Graded	9.47
Control, without Pre-school	9.29

$F_{Cov} = 2.6$, $p < .10$

$F = 1.97$, $p < .25$

Montessori children did best on the average on this test of repeating sente ces. The individual effort and attention required with the Montessori procedure very likely transferred to this tester-child relationship, for these children we reliably superior to the other non-graded primary group as well as the Control-without-Pre-school group. Over all, however, these results were not as reliable the foregoing tests, although the Montessori child's advantage on these tests of conventional intelligence is consistent with the pattern of other test results.

Task Initiation. Intended to measure the tendency to initiate investigativ behavior in relation to novel stimuli. Small figures are placed on the testing ble before the child enters the test room. No instructions are given while the tester is busy filling out information on the score sheet. Child is rated for a two-minute period on the degree of activity initiated with respect to the toys o the table. The situation is supportive and permissive, but no external encourag ment is given. Ratings vary from "no initiation" (rated 1) to "initiation with high degree of involvement" (rated 4). While this measure in the past has corre ted significantly with our other measures of Curiosity, it is apparently a compl variable, reflecting some degree of proneness to investigate along with a tenden to be assertive. Furthermore some children have learned "not to touch things th do not belong to you," so that while they may have a tendency to initiate invest gations, the tendency to obey previous instructions may be stronger in some case

Results - Task Initiation

Montessori, Non-Graded	2.00
Control, without Pre-school	1.88
Non-Montessori, Non-Graded	1.42
Control, with Pre-school	1.00

$F_{Cov} = 3.9$, $p < .05$

$F = 3.88$, $p < .05$

Montessori children showed strongest tendency to initiate exploratory behavior. The most striking aspect of these data, however, are the results for the control group that had pre-school experience; not one child showed initiatory behavior--all children in this group received a rating of "1," no initiation. Evidently the pre-school experience interacted with the obedience-training emphasis in the kindergarten control classroom, resulting in inhibition of self-initiated investigation. By contrast, the control group from that same kindergarten classroom, which did not have the pre-school experience obtained initiation ratings almost as high as the Montessori children. One can only speculate about the reasons for complex data in relation to a complex test. It might well be that a component of assertiveness still remained in those children that had not received the earlier disciplinary training in preschool, which had been socialized out of group that had obedience emphasis both in pre-school and conventional kindergarten.

Remaining tests of Curiosity. Two tests, the Curiosity Box and the Manipulation Board were used to assess investigatory behavior. Unlike the Task Initiation test, above, this testing is preceded by the instructions "Here is something for you to play with." Observations include Verbal Behavior while investigating as well as aspects of the investigatory Activity itself. Activity includes Tactual, Manipulatory, and Visual exploration plus Movement of the Subject while investigating and Movement of the Material by the child while investigating. The Manipulation Board is a 6" by 12" blue board with various pieces of hardware (bolt, latch, cotter pin, etc.) mounted on it. The Curiosity Box is a colorfully painted box

with various compartments, holes to look into, and a variety of gadgets to manipulate and touch.

Results - Curiosity Box and Manipulation Board

No statistically reliable trends were obtained, but the data are suggestive. The Montessori children achieved numerically highest scores on all four measures: Curiosity Box (Verbal and Activity); and Manipulation Board (Verbal and Activity). The remaining experimental and control groups showed no consistent advantage with respect to one another. The only difference that showed statistical reliability was that between Montessori and the Control group without Pre-school. This one finding was consistent with earlier reliable outcomes.

The Curiosity variable, as we have attempted to measure it, is a complex one, and test reliability has not been satisfactorily high, although a minimum degree of consistency has been observed. This unreliability of course interferes with detection of educational effects.

Furthermore, our own experimental work has shown that other variables such as the closeness of the relationship between tester and child affects exploratory behavior. Other research where children have been tested three times in succession over several months, shows that situational factors are important; the mood of the child on a particular day can decidedly affect exploratory tendencies.

In view of the theoretical significance of the Curiosity variable, however, we intend to pursue its course of development and the factors affecting it. Many teachers are interested in developing it in children or maintaining it in those children who manifest it early. Therefore, this variable needs more systematic work and we will continue to try to isolate and study those children who show a consistent propensity to investigate over repeated testing and under a variety of testing conditions.

Conclusion

We have tested 72 children including two experimental groups and two control groups. We have found that continuity from prekindergarten to non-graded primary shows children develop to good advantage on a number of psychological tests ranging from conventional intelligence measures to innovative behaviors. One of the significant findings showed that even in the more permissive non-graded situation, the children outperformed their control-group peers in measures of Impulse Control, Analytic Thinking, and other measures demanding attention and self-regulated behaviors.

Of course this is only the first step. The educational effects should be assessed with additional measures; other classrooms with other teachers representing each educational program must be studied; and in coming years these same children should be followed up on a longitudinal basis. Our goal for the future is to evaluate early education and to help point the way toward future positive and innovative developments. With continuing support from foundations like Carnegie, and with continuing cooperation from the public schools and the Cincinnati Montessori Society, such a goal is most certainly attainable.

The Sands School Project represents a cooperative research effort between the private and the public sector, and between the theoretical interests of psychology and the practical interests of the educator. Such an alliance is unusual; a successful one, as this has been so far, is exceptional in the best sense of the term.